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ANNALS

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NEW COLORADO LACHNINI

C. P. GILLETTE and M. A. PALMER,
Colorado Agricultural Experiment Station.

Colorado, because of its wide range in altitude and climatic conditions, its extensive native flora and large number of species of introduced plants, has a large aphid fauna, nearly 300 species of which may be seen in the collection of the Colorado Agricultural College.

The authors of this paper, in undertaking to prepare a list of Colorado Aphididæ, about three years ago, found that there were many undetermined and apparently new species of *Lachnini* in the collection, which should be included, and undertook to work up the Lachnids of the state, so far as possible, before publishing. This paper is the result of our attempt to collect and describe the unknown species belonging to this group in Colorado. The work has been supported by the Adams and Hatch Funds of the Agricultural Experiment Station.

Some of the species in this group are rather difficult of separation. We have found it almost essential, in several instances, to obtain eggs or stem-mothers in the spring and rear the later broods from them under control conditions and record the color characters in all stages as shown in the accompanying color plates. The color markings that are due to waxy secretions, we have found quite constant and diagnostic in fresh unrubbed examples which are often difficult to find in nature. The color patterns in the first-instar lice are often very characteristic of the species, which is the reason for including so many of the young lice on the color plates.

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It has also been interesting to note that practically all of the Lachnids studied seem to be confined in nature each to a single species of conifer, except in case of *Schizolachnus tomentosus L.* Attempts to start colonies on other than their regular hosts failed except, only, in the case of *L. apini* on *Pinus edulis*, where quite prosperous colonies were obtained. It has not, however, been taken on this host in nature. In the Essigellas, this habit has not been as pronounced, though there seems to be the same tendency, and occurrences on more than one host species have been rare or uncertain of determination.

There may be some criticism of this paper on the ground that many of the forms were reared in the insectary instead of being taken in their natural habitats. The breeding was all done in a natural temperature house with conditions as nearly normal as possible. The aphids were fed either on branches set in water, or on little potted trees transplanted from the hills. In the second place, careful comparisons were made, whenever possible, with examples taken in nature and never have any specific differences been found. The only differences found have been in size alone, and that in only one case where very few were taken. Even in a case where part of a lot of aphids were reared indoors in the early spring where the higher temperature caused much more rapid development than their sisters outdoors, no differences of any sort could be detected. It seems, therefore, reasonably certain that these specimens represent the normal characters of their respective species.

The bark feeding species, and especially those occurring among the needles, so imitate the rough bark and scales that it is very difficult to see them, and our collections would have been far fewer had we not early learned to locate the lice by the aid of the ants that are their constant attendants. What the trained pointer is to the sportsman the ants are to the aphidologist who hunts his game in its natural haunts.

An interesting observation in this connection has been that, while practically all species of ants visit the aphids for their excretions, it is a rare thing to find two species of ants working together on the same tree or plant.

ACKNOWLEDGMENTS.

We wish to express our great appreciation of the assistance received in this study from Dr. A. C. Baker, of the Bureau of

Entomology, Washington, D. C., and Professor H. F. Wilson, of the University of Wisconsin, who have very kindly examined many of the species described in this paper, and given us their opinions as to whether or not they were described forms. However, we assume all responsibility for any errors in the designation of species.

Subtribe ANŒCINA.

Genus ANŒCIA Koch.

Ancœcia graminis, n. sp.

Apterous Virgogenia, (Plate I, 1, and Plate II, 6, 8, 9, 10 and 12). Described from 14 specimens taken in Cherokee Park, Colorado, September 6 to 16, 1915, on roots of grass, by L. C. Bragg.

General color, dull black covered with slight powder; antennæ and legs dark dusky throughout; cornicles concolorous with body. Lateral hairs capitate. Length of body, 2 mm.; width, 1.25 mm.; length of hind tibia, .65 to .80 mm. Cornicles small, .13 mm. in diameter at base and covered with numerous fine hairs, much more thickly set than on body. Beak barely attaining 3d pair of coxæ, joints measuring .09, .12 and .03 mm. respectively. Length of antenna .65 to .80 mm., joints in following ratio: III, 21; IV, 11; V, 14; VI, 16 plus 5; sensoria; III, 0–1; IV, 0–2; V, 0–4; VI, 0–3, protruding; unguis cylindrical. Hairs on antenna, .06 mm., slightly exceeding diameter of joints and rather numerous; hind tibia, .65 to .80 mm., hairs, .05 to .06 mm., exceeding diameter of tibia by one-half; some hairs erect and others semi-erect and moderately abundant; hairs on body same as on tibiæ. Ocular tubercles large. On lateral margins of abdominal segments 1, 2, 3, 4 and 7 appears a circular structure, either wax gland or very slightly elevated tubercle about the same diameter as the mouth of the cornicle.

Alate Virgogenia, (Plate II, 5, 11 and 13). Described from a single example taken in Fort Collins, on roots of *Hordeum*, by L. C. Bragg.

Color notes from life were not taken. In balsam, thorax and head are dusky, abdomen pale with dusky cross bands more or less coalesced from third segment posteriorly; legs and antennæ dusky throughout; cornicles dusky. Length of body, 2 mm. Eyes with ocular tubercles. Cornicles rather thickly covered with fine hairs, .05 mm. in length; body rather sparsely set with similar hairs, middle of hind tibia bearing fine hairs, .10 mm. in length, nearly twice the diameter of the tibia and mostly erect on outer side of tibia, drooping on inner side; hairs

on antenna, fine, .07 mm., slightly exceeding diameter of antenna. length of antenna, .90 mm. Ratio of joints, III, 25; IV, 15; V, 16; VI, 15 plus 5; secondary sensoria, III, 3; IV, 4; V, 4; VI, 2; unguis cylindrical. Hind tibia, .85 mm. Wings hyaline, stigma dusky brown, media once branched, stigmal vein gently curved in proximal half; hind wings with both cross veins present.

Oviparous Female, (Plate II, 7). Described from 8 specimens taken on roots of grass in Cherokee Park, September 6 and 16, 1915, by L. C. Bragg.

Color notes not taken from life; specimens in balsam appear considerably lighter in color than the virgogenia in general, but with head dusky, also broad cross bands on thoracic segments and 8th abdominal segment; legs and antennæ dusky throughout. Length of body, 1.8 mm., width, .90 to 1 mm.; hind tibia, .50 mm.; length of antenna, .50 to .57 mm., ratio of joints, III, 12; IV, 7; V, 9; VI, 10 plus 4; no secondary sensoria. Hairs as in virgogenia; no sensoria apparent on hind tibia.

Collections as follows: Apterous virgogenia, on roots of grass, Cherokee Park, Colo., September 6 and 16, 1915, by L. C. Bragg. Alate virgogenia, on roots of *Hordeum*, Fort Collins, Colo., date unknown, by L. C. Bragg. Oviparous female, on roots of grass, Cherokee Park, Colo., September 6 and 16, 1915, by L. C. Bragg.

Anœcia setariæ, n. sp.

Apterous Virgogenia (Plate I, 2; Plate II, 1). Described from example taken on *Setaria* root, Fort Collins, Colorado, September 21, 1917, by L. C. Bragg.

General color, pale orange yellow shading to brownish on head, with slightly dusky dashes on dorsum of abdominal segments 4, 5, 6 and 7, and lateral areas on all. Antennæ and legs pale yellow, slightly dusky on tarsi, tips of tibiæ and distal ends of femora; cornicles same color as body. Length of body, 1.9 mm.; length of hind tibia, .60 mm.; length of antenna, .60 to .65 mm.; joints in following ratio: I, 7; II, 6; III, 24; IV, 9; V, 11; VI, 11 plus 4; secondary sensoria; III, 0; IV, 0; V, 0; unguis rather stout and finger-like. Hairs on antennæ and tibiæ, fine, set at angle of 45 degrees, .05 mm. in length, hardly equal to diameter of joint; hairs on body similar, on cornicles same as body, only slightly more numerous. Beak attaining 1st abdominal segment, joints measuring .10, .10 and .03 mm., respectively; cornicles measuring .12 mm. in diameter at base.

A large proportion of forms intermediate between alate and apterous were taken.

Alate Virgogenia (Plate I, 3; Plate II, 2). Described from a single specimen on *Setaria*, Fort Collins, Colo., taken Sept. 21, 1917, by L. C. Bragg.

General color, black on head and thorax, prothorax dusky, prothoracic membranes and abdomen pale green; slight dusky dashes on dorsum of abdomen, cornicles concolorous with abdomen, legs and antennæ pale throughout. Length of body, 1.9 mm.; length of hind tibia, .70 mm.; length of antenna, .70 mm., joints in the following ratio: I, 7; II, 7; III, 25; IV, 10; V, 11; VI, 12 plus 4; secondary sensoria, III, 5; IV, 2; V, 1; unguis stout and finger-like; cornicles .15 mm. in diameter at base. Hairs on antennæ and tibiæ fine, semi-erect or drooping, .05 mm. in length, hardly exceeding diameter of joint. Wings hyaline, stigma short and broad, stigmal vein gently curved, media once branched; hind wing with two cross veins.

Another specimen taken September 16, 1917, on *Setaria*, Fort Collins, Colo., by C. P. Gillette, agrees with this one excepting that the third joint of the antenna bears only two to three sensoria, the appendages are all dusky throughout, and forewing is without cross veins.

Collected as follows, all on *Setaria* sp.:

Apterous Virgogenia:
On roots, Fort Collins, Colo., September 10, 1917, C. P. Gillette.
On roots, Fort Collins, Colo., September 21, 1917, L. C. Bragg.
Intermediate Form:
On roots, Fort Collins, Colo., September 26, 1917, C. P. Gillette.
Alate Virgogenia:
On stems, Fort Collins, Colo., September 21, 1917, L. C. Bragg.
On stems, Fort Collins, Colo., September 16, 1917, C. P. Gillette.

Subtribe EULACHNINA.

Genus ESSIGELLA Del Guercio.

Essigella hœrneri, n. sp.

Apterous Virgogenia (Plate I, 5; Plate II, 15, 16, 17, 18). Described from numerous examples taken on needles of *Pinus edulis* in Owl Canon, Larimer County, Colo., September 26, 1921, by J. L. Hoerner.

General color, apple green on posterior and lateral portions of abdomen, shading into yellowish on median anterior portion of abdomen and thorax, becoming yellowish brown on prothorax and head. No dusky spots evident. Legs pale throughout or only tips of tarsi dusky. Antennæ pale, shading to dusky in usual locations. Size of body, 1.4 by .50 mm. Length of tibia, .55 to .65 mm. Length of antenna, .42 mm.; ratio of joints, I, 5; II, 5; III, 12; IV, 8; V, 8 plus 3; without secondary sensoria; unguis bearing primary sensorium. Hairs slightly capitate,

minute, about .01 mm., on outer side of hind tibia, a little longer towards tip and on inner side of tibia; almost invisible on antenna and body except posterior end, where they are simple and attain .05 mm. Cornicles mere rims. Beak attaining third pair of coxæ to middle of abdomen. Front and middle femora somewhat thickened.

Found between needles at bases. Very active.

Three examples taken on *Pinus ponderosa* near Fort Collins, Colo., by L. C. Bragg, also 12 specimens taken on *Apinus flexilis* in Estes Park, Colo., July 22, 1922, resemble these excepting, only, in size, being 1.80 mm. in length, and hind tibia .70 mm. Also, 3 specimens taken May 29, 1912, on *Pinus ponderosa*, near Fort Collins, by L. C. Bragg, appear to agree.

Oviparous Female (Plate I, 6 and Plate II, 19). Described from numerous examples taken on *Pinus edulis* in Owl Canon, Larimer County, Colo., October 26, 1921, and November 6, 1921.

General color, dusky apple green, shading to yellowish brown on prothorax and head; legs and antennæ pale brownish with tarsi, tips of hind tibiæ and tips of joints and entire terminal joints of antennæ dusky. Length of body, 1.40 mm.; length of hind tibia, .40 mm. to .45 mm.; length of antenna, .35 mm.; joints in following ratio: I, 4; II, 4; III, 10; IV, 6; V, 7 plus 3. Sensoria as in virgogenia; sensoria in hind tibia, rather large, 11 in number and on inner side. Hairs as in virgogenia. Many found containing two ova.

This species is distinguished from *Essigella pini* Wilson by the absence of dusky spots, and from both this and *californica* by the extreme shortness of the tibial hairs.

Collections as follows, on *Pinus edulis* and in Owl Canon, Larimer County, Colo.:

Apterous Virgogenia:
September 26, 1921, J. L. Hoerner.
September 24, 1922, F. C. Hottes.
November 6, 1921, J. L. Hoerner and M. A. Palmer.

Oviparous Female:
October 27, 1921, C. L. Corkins.
November 6, 1921, J. L. Hoerner and M. A. Palmer.

Essigella fusca, n. sp.

Apterous Virgogenia (Plate I, 9 and Plate II, 20, 21). Described from 13 examples in all, taken on *Pinus ponderosa;* 8 taken July 27, 1917, at Log Cabin, Colo., by L. C. Bragg; one taken July 19, 1923, in Estes Park, Colo., and 4 descendants of the same reared in the insectary at Fort Collins.

Ground color, pale green, marked on entire dorsum by solid dusky patch, greenish on median portion; dark area ending very abruptly on lateral line of body; in some individuals this dark coloration is very faint and dusky spots appear instead of a solid area; head and pronotum yellowish, only slightly dusky; posterior margins of 7th and 8th abdominal segments green; spots at bases of hairs dusky; cornicles black; eyes reddish brown; antennæ pale yellowish, dusky on tip of 3d joint, and entire 4th and 5th joints; legs mostly dusky to blackish; 1st and 3d femora dusky brown with pale spot just at tip of 3d pair, middle pair sordid yellowish; 1st and 3d pairs of tibiæ and tarsi black, 2d pair sordid brown. Length of body, 2 to 2.20 mm.; width, .50 to .80 mm.; hind tibia, .80 to 1.15 mm.; antenna, .45 to .55 mm.; ratio of joints as follows: I, 6; II, 7; III, 17; IV, 10; V, 10 plus 3; no secondary sensoria; unguis bearing a primary sensorium. Beak attaining 3d pair of coxæ. Hairs on antennæ very small and inconspicuous, on tibia, .06 to .07 mm., about once and a half the diameter of the tibia, slightly capitate and set at an angle of 45 degrees, somewhat shorter on inner side of tibia and body. Front and middle femora quite heavy. Eyes reddish brown without tubercles.

Found on needles, mostly on dorsal side at base between needles. Very quick and active.

Young (Plate I, 10). *1st instar:* Born from apterous virgogenia, at first, pale green throughout with dusky dots marking bases of hairs.

3d instar: General color, yellowish apple green, marked with dusky to black areas on lateral half of thoracic segments extending near to median line; dusky spots at bases of hairs.

Alate Virgogenia (Plate I, 11 and Plate II, 23, 23a). Described from 25 specimens, all taken on *Pinus ponderosa*, two in Denver, Colo., October 7, 1918, by L. C. Bragg; 23 reared from *apterous virgogenia* taken in Estes Park, July 19, 1923, matured July 27 to August 14, 1923.

General color: abdomen glaucous green, marked by broken dusky bands or series of dots on each segment and cauda; head and thorax dark brown; all tibiæ and tarsi black; first and third femora dark brown, lighter toward proximal end, second femur brownish yellow except the very tip; antenna dusky brown except the very base of third joint. Body covered throughout with slight powder. Wings held loosely roof-like in repose. Eyes reddish brown. Size of body, 1.70 mm. by .75 mm.; length of hind tibia, 1.05 to 1.30 mm.; length of antenna, .57 mm.; ratio of joints: I, 7; II, 8; III, 21; IV, 14; V, 10 plus 3; secondary sensoria, III, 2 to 3; IV, 0; V, 0; unguis bearing primary sensorium. Hairs slightly capitate .06 to .08 mm. in length, about twice the diameter of the tibia, shorter on inner side of tibia;

hairs on antenna very small, .01 mm., and sparse. Wings hyaline, stigma dusky and cell anterior to stigmal vein inclined to be smoky; stigmal vein straight, media once branched; hind wing with two cross veins. First and second pairs of femora thickened.

Found on needles, but not at bases as the apterous are.

Oviparous Female (Plate I, 7 and Plate II, 25). Described from 25 examples taken on *Pinus ponderosa* along South St. Vrain Canon, Colo., October 21, 1922, and two examples taken on same food plant, October 1, 1922, Estes Park, Colo., by F. C. Hottes.

General color: yellowish dusky green with yellow predominating on head and prothorax; older individuals somewhat darker throughout; abdomen above with numerous small fuscous spots arranged in rows; cornicles small, slightly elevated and yellowish brown in color; femora and basal half of antenna light greenish yellow, end of antenna, entire tarsi and tibiæ dusky brown to black; eyes black. One to two large eggs, light in color, filling almost entire abdomen. Size of body, 1.70 by .50 mm.; hind tibia, .72 to .80 mm.; length of antenna, .47 mm.; ratio of joints: I, 5; II, 6; III, 14; IV, 8; V, 8 plus 4; no secondary sensoria. Hind tibia with about 20 large sensoria on inner side. Hairs slightly shorter than in virgogenia, .06 mm., only slightly exceeding the diameter of thickened hind tibia in some cases, in others exceeding by once and a half.

Eggs shining black, laid lengthwise on dorsal side of needle.

Found on needles located the same as virgogenia.

Male (Plate I, 8, and Plate II, 24). Described from two specimens taken on *Pinus ponderosa*, October 21, 1922, South St. Vrain Canon, Colo., and two taken on same host October 1, 1922, Estes Park, Colorado.

General color: dusky or olive green posteriorly, shading to light rusty brown on thorax and head; legs and antennæ same color as head, excepting tarsi, distal half of antennæ, and entire hind tibiae which are dusky. Size of body, 1.15 mm. by .33 mm.; length of hind tibia, .56 to .60 mm.; length of antenna, .45 to .52 mm.; ratio of joints: I, 5; II, 6; III, 18; IV, 10; V, 8 plus 3. Secondary sensoria as follows: III, 16; IV, 12; V, 2. Unguis bearing primary sensorium. Hairs proportionately as in oviparous or slightly shorter. Beak attaining first abdominal segments.

This species is distinguished from *Essigella californica* Essig. by the shorter tibial hairs and by having dorsum of abdomen dark in color in apterous virgogenia.

From *Essigella pini* Wilson, this species is distinguished by the forked media, simple in *pini*. Out of 23 specimens only one wing showed simple media. The hind tibia is longer, also being 1.05 to 1.30 mm. in *fusca*, compared with .85 mm. in *pini*.

Collections were taken as follows, all on *Pinus ponderosa:*

Fundatrix:
Fort Collins, Colo., May 8, 1908, L. C. Bragg.

Apterous Virgogenia:
Estes Park, Colo., alt. 8,500, July 19, 1923, M. A. Palmer.
Estes Park, Colo., alt. 8,500, July 24, 1921, C. P. Gillette.
Log Cabin, Colo., alt. 8,500, July 27, 1917, L. C. Bragg.
Estes Park, Colo., alt. 8,500,* July 27, 1923, M. A. Palmer.
Estes Park, Colo., alt. 8,500, August 6, 1923, M. A. Palmer.
Stove Prairie, Colo.,† alt. 8,000, August 21, 1922, F. C. Hottes.
South St. Vrain Canon, Colo., October 21, 1922, M. A. Palmer.

Alate Virgogenia:
Estes Park, Colo., alt. 8,500,* July 27, 1923, M. A. Palmer.
Estes Park, Colo., alt. 8,500,* August 14, 1923, M. A. Palmer.
Denver, Colo., October 7, 1918, L. C. Bragg.

Oviparous Female:
Estes Park, Colo., October 1, 1922, F. C. Hottes.
Bellevue, Colo., October 8, 1922, M. A. Palmer.
South St. Vrain Canon, Colo., October 21, 1922, M. A. Palmer.

Male: Same as collections for oviparous female and also Estes Park, Colo.,* September 11, 1923, M. A. Palmer.

Subtribe LACHNINA

Genus LACHNUS Burmeister

Lachnus sabinæ, n. sp.

Fundatrix (Plate IV, 10). Type specimens, 13 with numerous young about them taken on campus of the Colorado Agricultural College April 9, 1918, and May 23, 1922, on bark of small limbs of *Sabina scopulorum*. Closely resembles the virgogenia but somewhat stouter in form, and the antennæ and hind tibiæ a very little shorter. The dark brown dorsal markings, especially those on the lateral margins of the abdomen, are less noticeable or lacking. Joints 3 and 4 of the antenna usually have one sensorium each, and joint 5 has either one or two. Joints 3 and 4 are frequently connate; beak attaining but not surpassing hind coxæ. For other characters, see virgogenia.

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* Reared on little tree in insectary.
† Foothills twenty miles northwest of Fort Collins, Colo.

Apterous Virgogenia (Plate III, 1, and Plate IV, 11, 12). *Apterous Form:* Types 12 examples, taken on *Sabina scopulorum* by L. C. Bragg, in Fort Collins, August 20, 1918.

General color: light yellowish or pinkish brown, somewhat heavily covered with white powdery secretion, but leaving exposed upon the dorsum a double row of three dark-brown spots on the second and third thoracic and the first abdominal segments, a row of four similar spots on either lateral margin of segments 1 to 4, and 7 and 8 of the abdomen, and a double transverse band of the same color joining a dark area about the cornicles, the middle portion of segments 4 and 5 of the abdomen also showing a dark area; cauda, anal and genital plates, and distal ends of antennæ, femora and tibiæ, as well as all tarsi and the eyes, black; conical base of cornicles rather small, the diameter not exceeding the length of the hind tarsi; beak extending well past the hind coxæ. Length of body, 3.10 mm.; width, 2 mm.; antenna, 1.10 mm.; hind tibia, 1.40 mm. Joints of antenna in the following ratio: I, 6; II, 7; III, 28; IV, 11; V, 12; VI, 10 plus 2. Sensoria very uniformly III, 0; IV, 1; V, 2.

Specimens taken in Denver, September 2, 1915, on red cedar (*Sabina scopulorum*), also agree with the above description.

Alate Virgogenia (Plate III, 4, and Plate IV, 13, 17). Described from a single specimen taken along with the apterous form mentioned above, and 15 specimens taken in Estes Park, August 10, 1923.

Ground color and marking of abdomen practically as in the apterous form. Head and thorax rusty brown; tarsi, extreme ends of tibiæ, the greater portion of the femora, black or blackish; antennæ dusky, darkest towards the tip; antennæ 1.20 mm.; joints in approximately the following ratios: I, 8; II, 10; III, 45; IV, 17; V, 19; VI, 16 plus 3; sensoria as follows: III, 3 to 6; IV, 1 to 2; V, 2; unguis slender and finger-like. Hind tibia, 1.80 mm.; hairs long and moderately stout, those on the middle of hind tibia .22 mm., fully twice as long as the diameter of the tibia and erect; hairs on antenna .16 to .18 mm., over four times the diameter of the joint; beak extending well past 3d coxæ, as in apterous form. Wings hyaline, stigma and stigmal vein with smoky border, media twice branched.

Oviparous Female (Plate III, 3, and Plate IV, 15, 16). Described from six examples taken October 20, 1922, at Fort Collins, on *Sabina scopulorum*.

In general appearance and markings but little different from the apterous virgogenia, color more of a dusky brown, segments 4, 5 and 6 of the abdomen with large dark area nearly free from powdery secretion; marginal dark spots on the abdomen rather large and thoracic spots

usually united to form dark continuous dashes extending over second and third segments; tarsi, distal ends of tibiæ, knees, greater portion of femora, cornicles, distal ends of joints, 3, 4, and 5, all of joint 6 of the antenna, and the anal and genital plates, black. Beak attaining but not surpassing 3d coxæ, length about 3.80 by 2.25 mm.; antenna 1.50 mm.; joints in following ratios: I, 4; II, 5; III, 21; IV, 8; V, 9; VI, 7 plus 1; sensoria III, 1; IV, 1; V, 2, with little variation, but occasionally, III has none and II has 2; hind tibia, 2 mm., moderately swollen, and with a large number of circular sensoria; cornicles moderate in size, the diameter of the base not exceeding the length of the hind tarsus.

Male (Plate III, 5, and Plate IV, 14). Described from two examples taken along with the virgogenia, four examples taken November 5, 1919, at Fort Collins, one example taken October 12, 1917, at Fort Collins, and three examples taken October 20, 1922, at Fort Collins.

Alate, general color very dark brown, almost black, with transverse bands of white secretion on all the segments; cornicles black, moderate in size; entire legs, except extreme bases of femora, dark brown to black; antenna black or blackish throughout; wings somewhat smoky, especially along all the nervures except the media, which is twice-branched and very slender; stigma long, parallel-sided and dusky brown. Antenna, 1.40 mm.; ratio of joints: I, 6; II, 7; III, 40; IV, 17; V, 18; VI, 13 plus 3; sensoria, III, 30 plus; IV, about 12; V, about 6; hairs on tibiæ, same as in alate virgogenia.

The eggs are shining black, without powder, 1 by .50 mm. in size, and are deposited singly or in short rows on the leaves. A very few were found on the bark of small twigs.

Collections taken as follows, all on *Sabina scopulorum:*

Fundatrix:
Fort Collins, Colo., April 9, 1918, L. C. Bragg.
Longmont, Colo., May 16, 1915, L. C. Bragg.
Fort Collins, Colo., May 23, 1922, M. A. Palmer.

Apterous Virgogenia:
Fort Collins, Colo., August 20, 1918, L. C. Bragg.
Denver, Colo., September 2, 1915, C. P. Gillette.
Estes Park, Colo., alt. 8,500, August 10, 1923, M. A. Palmer.

Alate Virgogenia:
Fort Collins, Colo., August 20, 1918, L. C. Bragg.
Estes Park, Colo., alt. 8,500, August 10, 1923, M. A. Palmer.

Apterous Oviparous:
Fort Collins, Colo., October 12, 1917, L. C. Bragg.
Fort Collins, Colo., October 20, 1922, C. A. Bjurman.
Fort Collins, Colo., November 5, 1919, L. C. Bragg.
Longmont, Colo., November 7, 1914, L. C. Bragg.

Alate Male:
Fort Collins, Colo., October 12, 1917, L. C. Bragg.
Fort Collins, Colo., October 20, 1922, C. A. Bjurman.
Fort Collins, Colo., November 5, 1919, L. C. Bragg.

Lachnus sibericæ, n. sp.

Fundatrix.—The black, shiny eggs (Plate III, 11) of this louse were brought from Estes Park to the insectary of the Colorado Experiment Station. They were deposited on the pubescent side of the needles, usually well towards their tips. Hatching began April 16, 1922.

Young.—Color, when first hatched, and up to one day old, hazel brown, without powder; legs yellow, with tips of tibiæ, tarsi and knees brown; antennæ dusky towards the tips.

After feeding for two or three days, the lice are pink in color, covered with a white powder, and without distinct dark markings; head darker than body and less powdery; legs somewhat dusky throughout. Taken feeding on the bark of twigs near their tips.

Adult Fundatrix (Plate III, 7). Described from one example taken May 23, 1922, near Fort Collins, Colorado.

Body plump, sub-globular, pinkish cinnamon-brown in general color, with white pulverulence throughout, which is heavier along the segment lines of the abdomen and upon the head and thorax, and lightest along two dark longitudinal lines, more or less broken into blackish spots, extending over the dorsum from the prothorax to the tip of the abdomen. Aside from the blackish spots in these lines, showing most distinctly on the mesothorax and metathorax and joints 1, 2, 7 and 8 of the abdomen, the cornicles, cauda, anal plate, eyes, terminal joints of antennæ, and entire legs, except extreme bases of the femora, are black or blackish; beak slightly surpassing hind coxæ.

Size 2.50 mm. by 1.85 mm.; antenna 1.00 mm.; joints in following ratios: I, 6; II, 6; III, 25; IV, 11; V, 15; VI, 13 plus 3. No sensoria on joint III, or rarely a small one near distal end, like antenna of apterous virgogenia (Plate IV, Fig. 1); hind tibia, 1 mm.; all legs rather short and stout; hairs as described for apterous virgogenia.

Apterous Virgogenia (Plate III, 8, and Plate IV, 1, 4, 8). Described from three examples taken July 26, 1911, in foothills near Fort Collins, Colo.; eight examples by Ellsworth Bethel, June 16, 1908, at Boulder, Colo.; and six examples, June 10, 1918, at Boulder, by L. C. Bragg, all from *Juniperus siberica*, 17 specimens in all.

Perfect specimens are light gray in color because of a white powdery secretion that covers the entire body above and below. Rubbed examples are hardly distinguishable from the stem-mothers except by the somewhat longer tibiæ and antennæ. Body 2.60 to 3.00 mm. long, by 1.75 to 2.25 mm. wide; length of antenna, 1.00 to 1.10 mm.; ratios of

joints: I, 6; II, 6; III, 27; IV, 12; V, 17; VI, 15 plus 3. Sensoria: III, 0 or rarely 1; IV, 1–2; V, 2; unguis sharply set off and finger-like; hairs long and rather stout on middle portion of hind tibia, standing at angle of 80 to 90 degrees, and the longest as long as twice the diameter of the tibia.

Alate Virgogenia (Plate III, 10, and Plate IV, 2, 5, 7). Described from three examples taken June 9, 1922, reared from stem mothers described above, and one example taken June 10, 1918, by L. C. Bragg, Fort Collins, Colo.

Second Generation: Head, thorax and abdomen, dull black, with narrow, transverse white lines on most of the abdominal sutures above, and a small white spot on the lateral margins of each segment, the largest spots being just behind the large mammiform cornicles; legs black, except extreme bases of femora; antennæ brown at the base, shading into black in the distal half, and quite hairy; hairs as in apterous; wings hyaline, veins dusky brown and very slender except the costa and subcosta, stigma rather long, parallel sided and dusky brown in color; median vein very faint and once branched, stigmal vein straight; hind wing with two straight cross veins; ocular tubercle very small; beak attaining second abdominal segment.

Body 2.70 mm.; antenna, 1.05 mm.; joints in following ratios: I, 6; II, 7; III, 33; IV, 16; V, 25; VI, 19 plus 5. Antenna with sensoria as follows: III, 4–6; IV, 1–2; V, 2–3.

Oviparous Female (Plate III, 9, and Plate IV, 3, 6). Described from examples taken at Grand Lake, Colorado, October 10, 1921.

General color: light cinnamon brown, color markings as in apterous virgogenia described above, but with less powdery secretion; length, 2.50 mm.; hairs as in virgogenia; antenna with sensoria about as follows: III, 0; IV, 1 or 2; V, 2 or 3; VI with the usual terminal cluster and in addition a few small ones distributed over distal half, otherwise like virgogenia; hind tibia moderately swollen, 1.10 mm. long and having numerous small circular sensoria distributed throughout nearly the entire length.

This species is rather close to *Lachniella juniperi* Fab. as described and figured by Del Guercio in *Contribuzione Alla Conoscenza dei Lacnidi Italiani*, p. 312, and Plate XVII, but differs by having media once branched and by having fewer sensoria on the segments of the antenna of alate.

Male (Plate III, 12, and Plate IV, 9). Described from a single specimen taken on *Juniperus siberica*, Estes Park, Colo., September 11, 1923. (Reared on potted shrub in

insectary, a descendant of apterous virgogenia taken July 7, 1923).

General color, brown, similar to oviparous female, with pair of longitudinal rows of black areas on thorax and first half of abdomen; head, cornicles, entire legs and antennæ black; bands of white secretion on intersegmental lines.

Size, 1.83 mm. by 1 mm.; length of hind tibia, .35 mm.; length of antenna, .37 mm.; ratio of joints, I, 6; II, 7; III, 40; IV, 20; V, 22; VI, 20 plus 4; secondary sensoria, III, 7; IV, 4 to 5; V, 2; VI, 1 to 2; hairs as in other forms.

Lachnus splendens, n. sp.

Fundatrix (Plate V, 1). The black shining eggs of this louse were taken on needles of *Pseudotsuga taxifolia* in Estes Park, April 13, 1922. When the lice hatched, the eggs opened from the lower or inner end and the lice migrated to the bark of the twigs among the needles to feed.

Young.—Second and third instars, May 2, 1922.

Thorax and abdomen uniform rusty yellow except for two dusky patches on prothorax; head dusky brown on middle portion with a narrow median line and the lateral margins above the eyes white; legs and antennæ light yellowish, except the tip of the latter, and all the tarsi blackish; cornicles hardly visible.

Adults.—Taken May 11, 1922, reared from the young described above.

Head, thorax and abdomen rather uniformly dull, but light rusty brown with a distinct transverse black dash upon either side of the median line on the second and third segments of the thorax and the first and eighth segments of the abdomen; eyes, extreme tips of antennæ and tibiæ, and entire tarsi, genital and anal plates black; cornicles extremely small, even difficult to find. Well preserved specimens show a slight white pulverulence on the head and lateral margins of the thorax and three or four, usually broken transverse white lines upon the dorsum of the abdomen, and light patches on lateral margins of joints four and seven. Length of antenna, 1.00 mm.; joints in the following ratios: I, 6; II, 7; III, 27; IV, 10; V, 12; VI, 9 plus 3; sensoria, III, 0; IV, 0; V, 1.

Young.—2nd generation: (Plate V, 2, 3). Described from numerous young bred in the insectary. Practically the same as young fundatrix.

Apterous Virgogenia (Plate V, 3, 4, 5).

Immature examples, especially those about two-thirds grown, are delicate water-white in color with a pale green dorsal line on either side of the body, extending from the head to the 8th segment of the abdomen. These lines disappear as the lice approach maturity. Eyes, tips of antennæ and tibiæ, tarsi and the minute cornicles, black. The head and lateral margins of the thorax and abdomen are powdered and white, and transverse lines of the same powdery secretion show on practically all the joints of the thorax and abdomen. These show best in Plate V, Figure 4.

Another immature but beautiful and conspicuously marked form of this louse is shown at Plate V, Fig. 4. The head is light rusty yellow; the ground color of thorax and abdomen is a pale drab with dorso-lateral rows of large black spots, about 12 in number, on either side, and extending from the prothorax to the cornicles, where the largest spots occur. Except for the black spots this form resembles the pale form described above.

Mature Examples, (Plate V, 5 and Plate VII, 1). Described from examples taken June 5, 1922, on *Pseudotsuga taxifolia*.

Ground color, rusty brown, especially showing on head and thorax and middle portion of the abdomen; on the dorsum the four pairs of black dashes on the thorax and first abdominal segment; and corresponding black or dusky brown patches on all succeeding segments are present on well-matured individuals; tarsi, distal ends of femora and tibiæ and tips of antennæ, black or blackish; the minute cornicles, black; body about 2.50 mm. by 1.50 mm.; antenna, 1.00 mm.; ratios of joints: I, 6; II, 6; III, 23; IV, 10; V, 12; VI, 8 plus 3; the unguis a gradually tapering point beyond the large sensorium of joint 6 and not a digit-like appendage; sensoria; III, 0; IV, 0; V, 1; hind, tibia, 1.25 mm.; beak attaining 2d abdominal segment; hairs of body rather short and medium stout for the genus; those of the tibia at an angle of about 50 degrees with the outer side of the tibia, the longest ones barely attaining the diameter of the tibia in length.

Specimens taken June 20 and July 20, 1922, agree in every way with this description.

Alate Virgogenia (Plate V, 6, and Plate VII, 2, 3, 4). Described from a single specimen taken June 5, 1922, along with the apterous form and two others taken June 20, all bred in the insectary, and descendants of the fundatrices described above.

Head and thorax yellowish to rusty-brown, lightly covered with white powder; abdomen pale rusty yellow, darker on 3d, 4th and 5th segments, with narrow white lines marking most of the joints. The two greenish, longitudinal lines described on immature apterous virgogenia are noticeable here, at least on some specimens. Two spots

on the 8th abdominal segment, the anal and genital plates, distal ends of antennæ and tibiæ, the tarsi and the very small cornicles, black; costal and sub-costal veins and stigma, dusky brown; stigmal vein straight; media twice-branched. Length of body, 2.60 mm.; wing, 4.00 mm.; hind tibia, 1.65 mm.; antenna, 1.10 mm.; ratio of joints: I, 5; II, 6; III, 28; IV, 12; V, 15; VI, 9 plus 3; sensoria: III, about 5; IV, 1; V, 1; VI, with a fair-sized circular sensorium about its middle; cornicles small, slightly raised on a small and very flat conical base, apparently not raised at all until the proper lateral view is obtained; hairs of hind tibia at an angle of about 60 to 70 degrees with the surface, and the longer ones fully equalling the diameter of the tibia; beak attaining the 3d abdominal segment, the terminal joint rather short and stout.

Oviparous Female (Plate V, 7, and Plate VII, 7). Described from specimens taken from October 6, to November 6, 1922, in Estes Park, Colo.

In general appearance, very similar to apterous virgogenia, except that there is a heavier coating of pulverulence and the abdomen, posterior to the cornicles, is heavily coated with white secretion. A rather heavy row of dorso-lateral black spots on either side of the body extends from the prothorax to the sixth abdominal segment; other markings as in apterous virgogenia. Antenna, .90 mm.; hind tibia, 1.30 mm., moderately swollen and with numerous circular sensoria throughout nearly its entire length. Otherwise like apterous virgogenia.

Alate Male (Plate V, 9, and Plate VII, 6). Described from a single specimen taken on bark of twigs of *Pseudotsuga taxifolia* in Estes Park at an altitude of 9,000 feet, October 6, 1922.

Color: Head and thorax rusty yellow, darkest on head and mesothoracic lobes; abdomen light olive green; cornicles and eyes black; legs pale yellowish with knees, tarsi and extreme distal ends of tibiæ dusky to blackish; wings hyaline, media twice-branched, stigma dusky; antenna dusky-brown with extreme tip black; cornicles merely small black circles marking the openings; length of antenna, .90 mm.; ratios of joints: I, 5; II, 6; III, 24; IV, 11; V, 12; VI, 8 plus 2; sensoria; III, about 28; IV, about 7; V, about 7; unguis stout, not digit-like, ending in short, cone-like point; hind tibia, .92 mm.; hairs on middle of hind tibia at an angle of about 60 degrees, and the longest ones fully 1½ times as long as the diameter of the tibia.

Collections as follows, all on *Pseudotsuga taxifolia:*

Fundatrix:

Estes Park, Colo., alt. 9,000, May 22, 1922, M. A. Palmer.
Bellevue, Colo., alt. 6,500, May 28, 1923, F. C. Hottes.

Apterous Virgogenia:
Estes Park,* Colo., alt. 9,000, June 5, 1922, M. A. Palmer.
Estes Park,* Colo., alt. 9,000, June 12, 1922, M. A. Palmer.
Estes Park, Colo., alt. 8,000, July 7, 1922, C. P. Gillette.
Larimer Poudre Tunnel, Colo.,† August 12, 1922, F. C. Hottes.
Estes Park, Colo., August 18, 1921, M. A. Palmer.
Fork Collins, Colo., August 21, 1922, C. P. Gillette.
Estes Park, Colo., alt. 9,000, September 18, 1921, M. A. Palmer.
Pingree Park, Colo.,‡ alt. 9,000, August 26, 1923, M. A. Palmer.

Alate Virgogenia:
Estes Park,* Colo., June 5, 1922, M. A. Palmer.
Estes Park,* Colo., June 20, 1922, M. A. Palmer.
Pingree Park, Colo., alt. 9,000, August 26, 1923, M. A. Palmer.

Apterous Oviparous:
Estes Park,* Colo., October 27, 1922, M. A. Palmer.
Estes Park,* Colo., November 4, 1922, M. A. Palmer.
Fort Collins, Colo., November 11, 1909, M. A. Palmer.

Alate Male:
Estes Park,* Colo., October 6, 1922, M. A. Palmer.

Lachnus solitarius, n. sp.

Fundatrix (Plate XIII, 23). Described from 6 specimens taken on *Pinus ponderosa* near Bellevue, Colo., altitude 8,000, June 5, 1922, by J. L. Hoerner.

General color: dull dusky brown throughout, with six longitudinal rows of black dots on dorsum; bases of femora and basal portion of third antennal joint brownish yellow, remaining parts of legs and antenna black; cornicles and eyes black. Ocular tubercles very small and inconspicuous. Hind tibiæ with rather pronounced curve; all femora rather heavy. Beak attaining middle of abdomen. Size of body, 3 mm. by 2 mm.; length of hind tibia 1.25 to 1.60 mm.; length of antenna 1.10 to 1.30 mm.; ratio of joints: I, 10; II, 9; III, 48; IV, 22; V, 22; VI, 15 plus 6; no secondary sensoria excepting one on fifth joint. Hind tibia with about 10 sensoria. Cornicles about .40 mm. in diameter at base. Hairs heavy and spine-like; on antenna, .07 mm., or twice the diameter of the joint, fairly numerous; on tibia, .10 mm. in length, about the same as diameter of tibia, numerous, and set at an angle of 45 degrees; hairs on body erect, spine-like, but shorter, .06 mm. Cornicles with a few long spines and numerous fine short hairs.

Young (Plate VI, 3).

General color: brownish yellow on dorsum of abdomen, shading to pale yellowish on thorax, speckled with dusky at bases of hairs; dusky brown on head and median portion of prothorax, but with pale median line sometimes covered with slight powder. Eyes and cornicles black; legs and antennæ pale orange yellow, with knees, tips of tibiæ

* Reared in insectary at Fort Collins, Colo.
† In hills 50 miles northwest of Fort Collins, Colo.
‡ Foothills, about 30 miles west of Fort Collins, Colo.

and entire tarsi dusky to black. Quite robust in appearance, feed on bark of twig near tip; solitary, wandering away from mother very soon after birth.

Apterous Virgogenia (Plate VI, 1, and Plate XIII, 18, 21a). Described from seven specimens reared in insectary June 20, 1922, from fundatrix taken near Bellevue, Colo., on *Pinus ponderosa* by J. L. Hoerner, and one specimen taken on the same host, June 21, 1922, in Poudre Canon, altitude 7,500.

General color: similar to fundatrix, but young adults often lighter on abdomen, being dusky yellowish to greenish in appearance and covered with slight bloom; antennæ, cornicles and legs same color as fundatrix.

Size of body, 3 mm. by 2 mm.; length of hind tibia, 1.50 mm.; total length of antenna 1.30 to 1.50 mm., ratio of joints: I, 8; II, 8; III, 50; IV, 20; V, 22; VI, 13 plus 7; no secondary sensoria excepting one on joint 5; antennal joints slender; unguis long and heavy, terminating in a rather slender point. Hairs on tibiæ .10 to .12 mm., and twice the diameter of tibia, spine-like, set at an angle of 45 degrees.

Alate Virgogenia (Plate VI, 2, and Plate XIII, 19, 20, 21b). Described from five specimens taken on *Pinus ponderosa*, Bellevue, Colo., June 20, 1922, by J. L. Hoerner; 2d generation reared from fundatrix described above.

General color: abdomen yellow brown with two longitudinal rows of black dots, head and thorax dark brown to black; antenna pale yellowish at base of third joint, remainder dusky; femora pale brownish yellow on proximal portions, dusky to black on tips of first and second pairs and distal half of third pair; cornicles dark dusky brown; eyes black, ocular tubercles very inconspicuous, due to small size and peculiar position. Length of body, 2.50 mm.; length of tibia, 1.55 mm.; length of antenna 1.30 mm.; ratio of joints, I, 6; II, 7; III, 50; IV, 22; V, 22; VI, 13 plus 6; secondary sensoria, III, 6 to 8; IV, 0 to 1; V, 0; unguis heavy, long, finger-like, ending in a slender point; antennal joints slender. Hairs on antenna spine-like, .04 to .05 mm., about twice the diameter of the joint; hairs on hind tibia spine-like, .11 to .13 mm., twice the diameter,of the tibia, varying from an angle of 45 degrees to nearly erect, some erect near base of tibia; cornicles with both long spines and fine short hairs as in apterous; body hairs spine-like. Wings hyaline, stigma dusky, stigmal vein straight and heavy, media faint and twice branched, hind wings with two cross veins. Beak slender, joints .20, .20, .10 mm., respectively.

Oviparous Female (Plate XIII, 22). Described from two examples, taken on *Pinus ponderosa*, in foothills near Bellevue, Colo., October 2, 1921, by J. L. Hoerner, and two taken on the same host in Estes Park, Colo., October 1, 1921.

Color, size and antennæ as in apterous virgogenia. Hind tibiæ slightly swollen and with sensoria on proximal two-thirds, length 1.45 to 1.90 mm.

The apterous forms have a swollen appearnacee as if parasitized. With the rather short legs and stout body they much resemble ticks or spiders. These aphids are found head down among the bases of the needles within an inch or two of the tip of the twig. Due to their color, which practically coincides with that of the bark, and their solitary habits, they are rather difficult to find and are very active when disturbed.

Collections were taken as follows, all on *Pinus ponderosa:*

Fundatrix:
Fort Collins, Colo., April 10, 1910, M. A. Palmer.
Bellevue, Colo., June 5, 1922, J. L. Hoerner.
Poudre Canon, Colo., June 12, 1922, C. P. Gillette.

Apterous Virgogenia:
Bellevue, Colo., June 20, 1922,* J. L. Hoerner.
Estes Park, Colo., July 4, 1923, M. A. Palmer.
Estes Park, Colo., July 22, 1922, M. A. Palmer.
Estes Park, Colo., July 27, 1922, C. P. Gillette.
Fort Collins, Colo., August 1, 1922, C. P. Gillette.
Estes Park, Colo., August 15, 1921, M. A. Palmer.
Bellevue, Colo., August 21, 1922, F. C. Hottes.

Alate Virgogenia:
Bellevue, Colo.,* June 20, 1922, J. L. Hoerner.

Oviparous Female:
Estes Park, Colo., October 1, 1922, M. A. Palmer.
Bellevue, Colo., October 2, 1921, J. L. Hoerner.

Lachnus terminalis, n. sp.

Eggs shining black, laid on dorsal side of needles. Taken in Owl Canon, Larimer County, Colo., April 4, 1923, by F. C. Hottes.

Young Fundatrix, 1st instar: Black throughout, including legs and antennæ; body covered with slight bloom, giving a grayish appearance. Located at base of terminal bud.

2d instar: Body smoky clay colored, with light powder to cornicles, posteriorly polished; legs black.

3d instar: Similar in color to apterous virgogenia.

Fundatrix. Described from two examples taken at Walsenburg, Colo., June 15, 1907, along with numerous examples of both alate and apterous virgogenia, specimens in balsam. Body, 2.80 mm. in length, with antennæ long and hind tibiæ 1.50 mm. long, otherwise like the apterous virgogeniæ.

* Reared in insectary in Fort Collins, Colo.

Apterous Virgogenia (Plate VI, 4, and Plate VII, 15, 16, 20, 22). Described from several examples taken, one in a place, on the bark of the new growth at the tips of the twigs of *Pinus edulis*, September 25, 1921, in Owl Canon, Larimer County, Colo.

General color of adults, a light cinnamon brown, some cases shading into green, especially in younger individuals, darkest upon the middle of the dorsum, where about 4 longitudinal rows of small brown spots may be traced; head, thorax and first four segments of the abdomen lightly powdered with white secretion, which, upon the abdomen, is distributed in rather well defined transverse bands upon the segments, and covering about one-half the surface; legs and antennæ tinged with the body color, but with tarsi, distal portions of femora and tibiæ, the knees and the distal ends of joints 3, 4 and 5, and all of joint 6 of the antenna and the cornicles dusky to black. Length of body, 2.25 mm.; hind tibia, 1.50 mm.; antenna, 1.00 mm.; ratio of joints: I, 5; II, 6; III, 28; IV, 12; V, 17; VI, 9 plus 3; sensoria, III, 0; IV, 1; V, 2; cornicles moderately raised, the conical base with a diameter a little greater than the length of hind tarsus; ocular tubercle well developed; hairs on middle of hind tibia standing at angle of about 65 degrees and having a length about equal to the diameter of the tibia; beak nearly attaining tip of abdomen; general form rather elongate, not subglobular.

These examples were located in every case by the presence of one or two ants. One or more young lice were found with the adult in each case. It is the habit of the young lice in this species to scatter when quite small and live solitary lives. This makes the lice difficult to find except through the agency of the ants and it is doubtless a great means of protection from parasitic and predacoeus enemies. In very luxuriantly growing young trees, sometimes the lice are abundant on growing tips.

Examples taken at Manitou, Colorado, July 3, 1919, by L. C. Bragg, average about 12 percent larger in measurements but seem the same otherwise.

Alate Virgogenia (Plate VI, 5, and Plate VII, 17, 21). Described from two examples taken on *Pinus edulis* August 6, 1922, in Owl Canon, Larimer County, Colo., and one example from same locality and host, October 5, 1922.

General color, practically as in apterous form, but with thorax somewhat darker; mesothorax in the darker examples, black or blackish; a white powder covers the head and thorax, being heaviest on the margins of the lobes and on the scutellum, and it also covers, lightly, the entire ventral surface; on the dorsum of the abdomen, the powder

is distributed in transverse bands on the segments and is lightest, sometimes almost absent, on segments 5 and 6; wings hyaline, 3.00 mm. long; media twice forked; cornicles, tarsi, distal portions of all femora and tibiæ, knees, distal ends of segments 3, 4 and 5, and all of 6 of antenna, black or blackish; conical base of cornicles rather large, the diameter being considerably greater than the length of the hind tarsus. Length of hind tibia, 1.70 mm., antenna, 1.05 mm.; ratio of joints: I, 5; II, 6; III, 29; IV, 12; V, 16; VI, 8 plus 3; sensoria about as follows: III, 4; IV, 1; V, 2; hairs somewhat longer than in apterous form and seem much longer on hind tibia on account of the more slender shank. The longer and more erect hairs stand at an angle of about 70–80 degrees and will measure from 1½ to 2 times the diameter of the tibia.

Oviparous Female (Plate VI, 6, and Plate VII, 19). Described from one example taken on *Pinus edulis*, Owl Canon, Larimer County, Colo., October 27, 1921, and several examples from same host and locality, taken October 18, 1922; reared in insectary.

General characters as in apterous virgogenia, except that entire hind tibiæ are black and are much thickened and set with circular sensoria, and the hairs are more erect, some of them being perpendicular, and, in length, equal to the diameter of the tibia, and show considerable variability in size. The largest examples taken are as large as the apterous virgogenia. The type from which Figure 6 of Plate VI was made was unusually small and a little more slender than the average, though fully mature.

Male (Plate VI, 7, and Plate VII, 18). Described from three males, one taken October 13, one October 18, and one October 19, 1923, in insectary from twigs of *Pinus edulis* brought from Owl Canon, 15 miles northwest of Fort Collins.

The general body color as in alate virgogenia, except that it is somewhat darker; entire legs, antennæ and cornicles black. As in case of the oviparous females, there is considerable variation in the size of different specimens, the larger ones measuring about as follows: body 2.35 mm.; hind tibia, 1.60 mm.; antenna, 1.30 mm.; wing, 3.10 mm.; tibial hairs long, slender, nearly erect (75–80 degrees); the longer ones fully twice as long as the diameter of the tibia; sensoria about as follows: III, 50 or more distributed throughout the entire length; IV, about 18 to 20; V, about 5; ratio of joints: I, 5; II, 6; III, 35; IV, 14; V, 20; VI, 10 plus 4.

The distinguishing characters in this species are the comparatively short 4th and 6th joints of the antenna with the large conical unguis that is fully one-third as long as joint 6, and the long slender rather erect hairs on the tibiæ.

Lachnus hottesi, n. sp.

Fundatrix. 3rd instar (probably). Described from five examples taken from Estes Park, Colo., on *Picea engelmanni*, June 13, 1923, by F. C. Hottes.

General color: brown or yellowish brown on head and prothorax, shading to black, sometimes with slight bluish tinge on abdomen; legs conspicuous yellow, with tarsi, tips of tibiæ, in some greater part of hind tibiæ, black; antennæ paler yellow with tips of joints dusky. Size, 3.20 mm. by 2 mm.; hind tibia 2.30 mm.; antenna same as apterous virgogenia. Joints rather heavy as though specimens were not mature, though several young were observed.

Young, same color as adult.

Apterous Virgogenia (Plate VI, 8, and Plate VII, 8, 9, 10, 13). Described from 8 examples taken July 8, 1923, from *Picea engelmanni* from Estes Park, Colo., by F. C. Hottes. Reared in insectary in Fort Collins, from fundatrix.

General color, uniform dull bluish black, without markings; legs and antennæ amber yellow, with extreme tip of antennæ, tarsi, and distal ends of tibiæ dusky. Body pyriform, 3 to 3.50 mm. by 2 mm.; length of hind tibia, 1.70 to 2.20 mm.; very little curved, almost straight; antenna, 1.55 mm.; ratio of joints: I, 10; II, 11; III, 60; IV, 25; V, 28; VI, 16 plus 7; secondary sensoria, III, 0 to 1; IV, 2 to 3; V, 1 to 2; unguis conical ending in a slender point. Hairs on hind tibia fine, moderately long, .08 mm., slightly exceeding diameter of tibia, numerous and set at an angle of 45 degrees; hairs on antenna slightly longer than those on tibia, .10 mm., twice the diameter of joint, numerous; hairs on body same as on antenna; cornicles rather large, .55 mm. in diameter; beak long as the body, joints rather stout, measuring .22, .26 and .10 mm., respectively.

Alate Virgogenia (Plate VI, 9, and Plate VII, 11, 12). Described from a single specimen taken July 17, 1923, on *Picea engelmanni* from Estes Park, Colo., by F. C. Hottes. Reared in insectary in same lot as apterous virgogenia.

General color: dull black throughout, slightly brownish on head. Legs orange yellow with only tarsi and tips of tibiæ dusky; antennæ pale orange with tips of joints dusky. No powdery markings whatsoever. Length of body, 2.80 mm.; hind tibia, 2.50 mm.; antenna 1.60 mm.; ratio of joints: I, 10; II, 10; III, 55; IV, 25; V, 25; VI, 11 plus 5; secondary sensoria as follows: III, 3 to 5; IV, 0; V, 0. Cornicles fairly large. Hairs as in apterous virgogenia.

These aphids are found on the older bark of younger limbs. They are, at times, found in large colonies. Just before

maturity, however, they all become restless and migrate. The yellow legs are very characteristic, showing up very conspicuously in a colony.

This species resembles *L. curvipes* on *Abies*, but is distinguished by longer hairs, absence of powder, light yellow legs with only tips of tibiæ dusky, and fewer sensoria on antennal joints.

Collections were as follows, all on *Picea engelmanni:*

Fundatrix: Estes Park, Colo., June 13, 1923, F. C. Hottes.
Apterous Virgogenia: Estes Park, Colo.,* July 8, 1923, F. C. Hottes.
Alate Virgogenia: Estes Park, Colo.,* July 17, 1923, F. C. Hottes.

Lachnus similis, n. sp.

Egg (Plate VIII, 6).

Taken on *Pinus contorta*, Bellevue, Colo., April 22, 1922, by J. L. Hoerner. Found on dorsal side of needles, 4 to 5 in a row; honey yellow when first laid, later shining black. Hatch with open end towards tip of needle. Size, 1.50 mm. by .70 mm.

Young Fundatrix. 1st instar: Hatched from above mentioned eggs, feeding on bark of twig, 20 mm. from tip.

General color: light cinnamon brown with head and a pair of diagonal dashes on prothorax black; legs and antennæ dark brown to black. Body everywhere lightly powdered with white. Beak not quite attaining tip of abdomen.

Fundatrix (Plate VIII, 1). Described from one example taken on *Pinus contorta* near Bellevue, Colo., May 9, 1922 (reared in insectary), and one example taken in same place and host June 8, 1922.

Color: yellow-brown to dark brown, marked with black as follows: on head, prothorax, mesothorax, dorsal dashes on metathorax and 1st, 2d, 3d, 5th, 6th and 7th abdominal segments, lateral dashes on 8th segment, and two longitudinal rows of black dots on abdomen; powdery markings as follows: on head and thoracic segments and 4th abdominal segment, and a broken median dorsal line, also small lateral spots on segments posterior to cornicles; eyes and cornicles black, legs pale yellowish with tarsi, distal half to entire tibiæ and distal two-thirds of femora black; antenna with terminal joint and tips of remaining joints dusky. Size of body, 3.75 mm. by 2 mm.; length of antenna, 1.40 mm. Length of hind tibia 2.40 mm.; antennal characters and hairs as in apterous virgogenia. Quick and spider-like in movements.

* Reared in insectary in Fort Collins, Colo.

Feeding on two-year-old bark of twig four inches from tip, or sometimes found with the colonies of young on young terminal shoots among sprouting needles.

Young, 2d Generation. *1st instar:* Born from above fundatrices. At first, pale lemon yellow throughout. Later dorsum of head and dorso-laterad areas on prothorax become dusky brown, and posterior portion of abdomen becomes rusty yellow or brownish; light parts become covered with slight pulverulence; legs colorless with distal ends of tarsi, tips of tibiæ and knees dusky; a pair of greenish to brownish spots on dorsum of first and second abdominal segments. Beak about the same length as body.

2d instar: Begin to assume color and markings of adult.

Apterous Virgogenia: Described from 15 examples reared from above described fundatrices, matured from May 31, to June 6, 1922; compared with 18 examples taken on *Pinus contorta*, Pingree Park, Colo., August 21, 1923.

General color and markings same as in fundatrix. Size of body, 3 mm. by 1.60 mm.; length of hind tibia 2.15 to 2.70 mm.; length of antenna, 1.50 mm.; ratio of joints: I, 10; II, 9; III, 60; IV, 25; V, 20; VI, 11 plus 4; sensoria, III, 1 to 2; IV, 1; V, 1; unguis, heavy conical. Hairs on hind tibia semi-spinelike to fine, .07 to .08 mm., length less than diameter of tibia, set at an angle of 45 degrees, numerous; body hairs about the same; hairs on antenna, .07 mm., exceeding diameter of joint, drooping hairs on cornicles long, .10 mm., numerous. Cornicles large, .55 in diameter at base. Beak attaining middle of abdomen. Joints, .21, .19 and .08 mm., respectively.

Alate Virgogenia (Plate VIII, 2, and Plate IX, 6, 7). Described from 28 examples reared in same collection as apterous virgogenia described above and compared with a specimen taken out of doors on *Pinus contorta*, Bellevue, Colo., June 17, 1922, and two examples taken on same host and locality, June 12, 1922, taken in nature.

General color: abdomen dark metallic brown; head, entire thorax, lateral portion of eighth segment, cauda and cornicles black; powdery markings as follows: strip across vertex, fine line on posterior margin of prothorax, line on lateral borders of anterior lobe of mesothorax, and thoracic lobes, entire scutellum, broken median line on abdomen, short dashes on segment lines on either side of median line, entire 6th and 7th segments, except a pair of dorso-lateral areas, middle of 8th segment, lateral margins of 4th and intersegmental spots between 1st and 2d, and 2d and 3d abdominal segments. Legs mostly black, short

space of tibia below knees pale yellowish; antennæ pale yellow except distal ends of joints which are dark.

Size of body 3 mm. by 1.10 mm.; length of hind tibia 2.50 mm.; length of antenna 1.30; ratios of joints: I, 7; II, 7; III, 55; IV, 25; V, 25; VI, 11 plus 4; secondary sensoria III, 5 to 8; IV, 1 to 2; V, 1; unguis heavy, conical. Cornicles large .50 in diameter. Wings hyaline, stigma and stigmal vein dusky brown, media twice forked. Beak attains middle of abdomen. Hairs on tibia, .08 mm., slightly exceeding diameter of tibia, fine and drooping; hairs on antenna .07 mm., slightly exceeding diameter of joint.

Oviparous Female (Plate VIII, 5, and Plate IX, 10, 11). Described from one example taken on *Pinus contorta*, Bellevue, Colo., October 2, 1921, and two taken on same host and locality, October 9, 1921, by J. L. Hoerner and C. L. Corkins.

General color, dark rusty brown to black in old examples, with cornicles, dorsum of meso- and metathorax, first abdominal and a sublateral spot on either side of the 2d abdominal segment, a dash on middle of 7th segment and a submedian dash on either side of the median line on 8th segment, eyes, all of legs except small section near base of 2d pair of tibiæ and bases of femora, and distal half of antenna black or blackish. Moderately powdery above on thorax, lateral margins of abdomen, broken median line on abdomen, entire 7th and 8th segments, a strip across the vertex and all of venter and face. Size 3.30 mm. by 1.50 mm.; length of hind tibia 2.50 mm.; antenna as in apterous virgogenia. Tibia with numerous small sensoria for entire length; but slightly swollen. Beak somewhat surpassing hind coxæ but not reaching cornicles.

Powdery secretion on tip of abdomen seems not to be used for covering eggs, as eggs appear shining.

Alate Male (Plate VIII, 4, and Plate IX, 9). Described from four examples taken on *Pinus contorta*, Bellevue, Colorado, October 2, 1921.

General color: abdomen dark rusty brown, slightly powdered laterally and beneath, line on vertex, line about all thoracic lobes, entire scutellum, margins of abdominal segments, the last broadest on median line; cornicles, antennæ, eyes, legs, except small space near base of tibiæ (which may be quite dark), thorax and head black. Stigma and costal margin dark, wing slightly smoky, media twice forked. Length of body 2.50 mm., length of hind tibia, 1.90 mm., length of antenna, 1.30 mm.; ratio of joints as in alate virgogenia; 3d, 4th and 5th joints thickly set with small tuberculate sensoria. Hairs on hind tibia, .07 mm., which is twice the length of the slender tibia.

Collections were taken as follows, all on *Pinus contorta:*

Fundatrix:
Bellevue, Colo., alt. 8,000, May 9, 1922, M. A. Palmer.
Bellevue, Colo., alt. 8,000, June 8, 1922, M. A. Palmer.

Apterous Virgogenia:
Bellevue, Colo., alt. 8,000,* May 31, 1922, J. L. Hoerner.
Bellevue, Colo., alt. 8,000,* June 3, 1922, J. L. Hoerner.
Bellevue, Colo., alt. 8,000, June 6, 1922, M. A. Palmer.
Bellevue, Colo., alt. 8,000, June 17, 1922, M. A. Palmer.
Tolland, Colo., July 2, 1909, W. W. Robbins.
Lar. Poudre Tunnel, Colo., August 12, 1922, C. P. Gillette.
Bellevue, Colo., alt. 8,000, August 21, 1922, F. C. Hottes.
Pingree Park, Colo., August 21, 1923, M. A. Palmer.
Lar. Poudre Tunnel, Colo.,* September 16, 1922, F. C. Hottes.

Alate Virgogenia:
Bellevue, Colo.,* alt. 8,000, May 31, 1922, J. L. Hoerner.
Bellevue, Colo.,* alt. 8,000, June 6, 1922, M. A. Palmer.
Bellevue, Colo., alt. 8,000, June 17, 1922, M. A. Palmer.

Oviparous Female:
Bellevue, Colo., alt. 8,000, October 2, 1921, C. P. Gillette.
Bellevue, Colo., alt. 8,000, October 5, 1922, M. A. Palmer.
Bellevue, Colo., alt. 8,000, October 10, 1921, C. L. Corkins.

Male:
Bellevue, Colo., alt. 8,000, October 2, 1921, C. P. Gillette.
Lar. Poudre Tunnel, Colo.,* Oct. 19, 1922, F. C. Hottes.

Lachnus murrayanæ, n. sp.

Fundatrix: Described from four examples from *Pinus contorta*, Bellevue, Colo., May 20, 1922.

General color: measurements and sensoria as in *Lachnus similis* described above, except a slight tendency to larger size and a distinct difference in the length of the hairs .10 mm. to .13 mm. on hind tibia, slightly exceeding diameter of tibia.

Apterous Virgogenia (Plate IX, 2). Described from six examples taken on *Pinus contorta*, Bellevue, Colo., June 3, 1922, by J. L. Hoerner.

General color and structural characters as in fundatrix, and, as in that case, the only character separating it from *Lachnus similis* is the character of the hairs, especially on the tibia. Their length is .10 to .15 mm. exceeding diameter of the tibia; they are also heavier and tend more to be erect, some at angle of 45 degrees and others almost erect. Antennal hairs .10 mm., twice diameter of joint, semi-erect.

Alate Virgogenia (Plate IX, 1 and 4). Described from two examples taken on *Pinus contorta*, Bellevue, Colo., June 3, 1922, by J. L. Hoerner.

General color and structural characters practically identical with alate virgogenia of *Lachnus similis* described above, excepting the

*Reared in insectary.

character of the hairs which are strikingly longer and heavier; on the middle of hind tibia they measure .13 mm. to .15 mm., almost twice the diameter of the tibia, rather heavy and set at an angle of 45 to 60 degrees, occasional hairs erect; on antenna .10 to .11 mm., or twice the diameter of the joint and set at an angle of 45 degrees.

Oviparous Female (Plate IX, 3). Described from one example taken on *Pinus contorta*, Bellevue, Colo., October 2, 1921, and five examples taken on same host and locality October 9, 1921, by J. L. Hoerner and C. L. Corkins. Characters same as *Lachnus similis*, excepting the same difference in hairs as found in the apterous virgogenia.

Alate Male (Plate IX, 5). Described from one example taken on *Pinus contorta*, Bellevue, Colo., October 2, 1921, and two taken same place and host, October 9, 1921, by J. L. Hoerner and C. L. Corkins. Same as male of *Lachnus similis*, excepting the same difference as found in the alate virgogenia.

Collections were made as follows, all on *Pinus contorta:*

Fundatrix:
Bellevue, Colo., alt. 8,000, May 20, 1922, M. A. Palmer.
Apterous Virgogenia:
Bellevue, Colo., alt. 8,000, June 3, 1922, J. L. Hoerner.
Bellevue, Colo., alt. 8,000, June 12, 1922, M. A. Palmer.
Alate Virgogenia:
Bellevue, Colo., alt. 8,000, June 3, 1922, J. L. Hoerner.
Oviparous Female:
Bellevue, Colo., alt. 8,000, October 2, 1921, C. P. Gillette.
Bellevue, Colo., alt. 8,000, October 9, 1921, J. L. Hoerner and C. L. Corkins.
Male:
Bellevue, Colo., alt. 8,000, October 2, 1921, C. P. Gillette.
Bellevue, Colo., alt. 8,000, October 9, 1921, J. L. Hoerner and C. L. Corkins.

Lachnus brevispinosus, n. sp.

Fundatrix: Described from two examples taken on *Pinus contorta*, Bellevue, Colo., May 23, 1922, reared in insectary from eggs. Same as apterous virgogenia.

Apterous Virgogenia (Plate VIII, 7, and Plate IX, 15). Described from two examples taken on *Pinus contorta*, Bellevue, Colo., June 17, 1923, reared in insectary from above fundatrix.

Very similar in color and structure to *Lachnus similis*, differing only in a less amount of white secretion, often quite inconspicuous and easily overlooked. Easily distinguished from both *L. similis* and *L. murrayanæ* by the character of the hairs; on the middle of the hind tibia, length, .04 mm., about one-half the diameter of the tibia, heavy, spine-like, blunt and decidedly drooping; hairs on antenna the same

length and about equal to diameter of joint. Cornicles, .40 mm. in diameter.

Alate Virgogenia (Plate VIII, 8, and Plate IX, 13, 14). Described from 7 examples taken on *Pinus contorta*, Bellevue, Colo., June 17, 1923, reared in insectary in same lot as above apterous virgogenia, 3d generation.

General color: abdomen, light pinkish cinnamon; head, thorax, cornicles, anal and genital plates, cauda, entire legs, antennæ except basal portions of segments 3 and 4, black; wings with costal vein and stigma very dark; cross veins of fore wing pale brown, media very faint and twice branched. Entire wing slightly smoky. No powdery markings on body. Size of body, 2.25 to 2.50 mm.; length of hind tibia, 2 mm.; length of antenna, 1.15 mm.; ratio of joints: I, 10; II, 8; III, 41; IV, 21; V, 22; VI, 12 plus 4; sensoria, III, 3 to 5; IV, 1 to 2; V, 1; unguis short, heavy and conical. Beak attaining middle of abdomen. Cornicles, .35 to .40 mm. in diameter. Hairs on middle of hind tibia, .05 mm., less than diameter of tibia, heavy, spine-like, drooping; hairs on antenna the same; body hairs same length, finer texture and erect.

Oviparous Female (Plate VIII, 10, and Plate IX, 17, 18, 19). Described from two examples taken on *Pinus contorta*, Bellevue, Colo., October 2, 1921.

General color, in older specimens, dull black with very little powdery secretion on head, thorax and tip of abdomen; legs black or blackish with yellow section near proximal end of tibia, quite short on 3d pair; antenna pale yellowish with distal ends of joints and entire 6th black. Structural characters practically as in apterous virgogenia. Hind tibia slightly swollen, with numerous rather tuberculate sensoria throughout almost its entire length.

Alate Male (Plate VIII, 11, and Plate IX, 16). Described from a single example taken on *Pinus contorta*, Bellevue, Colo., August 21, 1922.

General color: abdomen dark yellowish brown, shining; head and thorax shining black; legs entirely dark, without white markings; differing from *L. similis* only in the character of the hairs which are similar to those of alate virgogenia.

This species is found in same locations on the tree as the foregoing species, namely, on the bark of twigs, anywhere from the tip to several inches or a foot from the tip, at the bases of needles; usually not in very large colonies, at least not crowded. They are very active and often travel about a great deal.

Collections were taken as follows, all on *Pinus contorta:*

Fundatrix:
Bellevue, Colo., alt.,8,000, May 23, 1922, M. A. Palmer.
Estes Park, Colo., June 11, 1923, F. C. Hottes.
Estes Park, Colo., June 13, 1923, F. C. Hottes.

Apterous Virgogenia:
Bellevue, Colo., June 17, 1922, M. A. Palmer.
Estes Park, Colo.,* June 23, 1923, F. C. Hottes.
Chambers Lake,* alt. 9,100, June 30, 1923, M. A. Palmer.
Estes Park, Colo.,* July 11 to 24, 1923, F. C. Hottes.
Chambers Lake, Colo.,* July 14 to 24, 1923, M. A. Palmer.
Estes Park, Colo., July 27, 1923, M. A. Palmer.
Lar. Poudre Tunnel, Colo., August 12, 1922, F. C. Hottes and C. P. Gillette.
Bellevue, Colo., August 21, 1922, F. C. Hottes.
Estes Park, Colo., August 24, 1921, M. A. Palmer.

Alate Virgogenia:
Bellevue, Colo.,* June 17, 1922, M. A. Palmer.
Chambers Lake, Colo., June 30, 1923, M. A. Palmer.
Chambers Lake, Colo.,* July 17, 1923, M. A. Palmer.

Oviparous Female:
Bellevue, Colo., October 2, 1921, M. A. Palmer.

Male: Bellevue, Colo., August 21, 1922, F. C. Hottes.

The foregoing three species of Lachnids on *Pinus contorta* are apparently quite nearly related, and grade rather closely to each other. It even seemed questionable whether they could rightly be named as separate species until breeding experiments gave evidence of their separate identities. The progeny of one or two fundatrices of *Lachnus similis* taken May 9, 1922, consisted of 47 individuals, 24 alate and 23 apterous, all showing the typical *similis*† characters. *Lachnus brevispinosus*, progeny from a single fundatrix, were reared for 6 generations, including 17 individuals, and every example shows typical *brevispinosus* characters. From a collection of the same species made June 30, 1923, 34 examples, including one alate, were reared, all showing typical *brevispinosus* characters. No *Lachnus murrayanæ* were bred, but the fact that no lice with *murrayanæ* characters appeared in either of these other lines is of considerable significance. An observation of some value on this point is the fact that though in one case these species all occurred in the same place, in three collections of large numbers of *brevispinosus* in 1923, it was the only form found in the respective

* Reared in insectary.

† Two individuals appeared in company with these which showed *brevispinosus* characters, but this was probably due to strays from a *brevispinosus* colony which was on another branch of *Pinus contorta* in the same part of the insectary. This latter species is very active and wanders about so much that it was studied with considerable difficulty.

localities. A similar experience was had with *Lachnus similis*. These facts give evidence of the constancy of these characters and seem to give sufficient justification for specific determination.

Lachnus flexilis, n. sp.

Apterous Virgogenia (Plate X, 1; and Plate XI, 1, 5). Described from 10 examples taken on *Apinus flexilis*, Estes Park, Colo., July 22, 1922, and 6 examples taken in the same place August 18, 1921.

General color: dull black on abdomen, shining black on thorax, head dusky brown; in young adults, head and thorax pale yellowish green to greenish brown; legs dusky orange brown; tarsi, knees, tips of 1st and 2d pairs of tibiæ, all of posterior tibiæ, except a ring below the knees, black; antennæ dusky orange brown with distal portions of joints shading into blackish. Cornicles small and black. Shape pyriform. Size, 4 mm. by 2 mm.; length of hind tibia 3.25 mm.; length of antenna, 2 mm.; ratio of joints: I, 15; II, 10; III, 90; IV, 36; V, 41; VI, 18 plus 8; secondary sensoria, III, 0; IV, 0 to 2; V, 1. Unguis heavy, proximal half cylindrical, distal half conical. Hairs on hind tibia very short, .03–.04 mm., not over one-third diameter of tibia, slightly curved inward, very drooping, sometimes lying nearly flat, medium in texture and very numerous; hairs on antenna similar but rather sparse; hairs on body very small, .01 to .03 mm., rather sparse. Beak attaining middle of abdomen, joints rather stout, measuring .28, .20, .07 mm., respectively. Cornicles, .15 to .20 mm. in diameter, hairs on cornicles small and inconspicuous. Tibiæ and tarsi rather heavy.

Alate Virgogenia (Plate X, 2, and Plate XI, 2, 6). Described from two examples taken on *Apinus flexilis* in Estes Park, Colo., July 22, 1922.

General color: brownish black on entire dorsum; legs, antennæ and cornicles as in apterous virgogenia. Length of body, 4 mm.; length of hind tibia, 3 mm.; length of antenna, 2 mm.; ratio of joints: I, 12; II, 10; III, 90; IV, 39; V, 39; VI, 18 plus 7; IV and V somewhat shorter in one example; secondary sensoria: III, 17 to 25; IV, 3; V, 1; sensoria, flat, irregular in size, both large and small; unguis as in apterous. Wings slightly smoky, stigma and costal margin dark; media faint, twice forked; second fork near margin of wing. In one wing media fades out in place for second fork.

Young (Plate X, 3).

1st instar: pale sordid greenish with darker green or brownish spots, darker on posterior part of abdomen, arranged in two longitudinal rows from head to cauda; legs and antennæ pale greenish shading to dusky on the usual locations.

2d instar: dark brown on abdomen, otherwise as first instar; legs and antennæ darker.

3d instar: darker and practically the same as described above for younger adult apterous virgogenia.

Oviparous Female (Plate X, 4, and Plate XI, 3). Described from five examples taken on *Apinus flexilis* in Estes Park, Colo., September 18, 1921, and one example taken on same host and locality, September 21, 1922.

Same as apterous virgogenia, without any powdery secretion. Shape of body tending to be slightly more elongate than in virgogenia. Tibia not noticeably swollen, bearing very small and inconspicuous sensoria throughout its entire length. In some examples sensoria are not perceptible.

Found feeding on bark of one to two years growth. Very active and nervous, usually waving hind legs, traveling away quite rapidly when disturbed.

Collections were taken as follows, all on *Apinus flexilis:*

Apterous Virgogenia:
Estes Park, Colo., alt. 8,000, July 22, 1922, M. A. Palmer.
Estes Park, Colo., alt. 8,000, August 5, 1922,* M. A. Palmer.
Estes Park, Colo., alt. 8,000, August 18, 1921, M. A. Palmer.

Alate Virgogenia:
Estes Park, Colo., alt. 8,000, July 22, 1922, M. A. Palmer.

Oviparous Female:
Estes Park, Colo., alt. 8,000, September 18, 1921, M. A. Palmer.
Estes Park, Colo., alt. 8,000, September 21, 1922, M. A. Palmer.

Lachnus apini, n. sp.

This species resembles *Lachnus coloradensis* Gill., but is distinguished from it by the decidedly numerous hairs which are quite sparse in *coloradensis*, by the greater length of the third antennal joint in proportion to other joints, often exceeding all following joints in length, by the character and number of sensoria in the 3d joint of the antenna of the alate virgogenia, being three or more times as numerous and shallow instead of tuberculate, and, finally, by the total absence of waxy or powdery secretion on any of the forms.

Fundatrix. Described from four examples taken on *Apinus flexilis*, Chambers Lake, Colo., June 30, 1923.

General color: chocolate brown, dull to somewhat shining, without white secretion except on pleuron of thorax and face beneath eyes;

* Reared in insectary in Fort Collins, Colo.

antenna dusky except proximal half of 3d joint; legs dark brown to black with extreme bases of femora and middle portions of all tibiæ pale yellowish. Cornicles darker than body. These may have lacked powder on account of being old adults. Size of body, 3 mm. by 2 mm., length of hind tibia, 2.50 mm.; length of antenna, 1.30 mm. Other characters as in apterous virgogenia.

Young (Plate X, 6). Born from fundatrix described above.

1st instar: similar to later instars but paler and dark markings less pronounced.

Later instars: General color, pale sordid yellowish with abdomen tinged with salmon; two broad dark bands on dorsum of head and prothorax; a double row of dark green to black spots forming a more or less quadrate patch extending over abdomen; mottled with whitish bloom much as adult on median, intersegmental lines and lateral margins of body. Legs and antennæ sordid pale yellow with usual parts black.

Apterous Virgogenia (Plate X, 7, and Plate XI, 9, 10, 14). Described from 12 examples taken on *Apinus flexilis*, Estes Park, Colo., July 22, 1922, and five examples taken from same host and locality, August 16, 1921.

General color, light to dark dusky brown, mottled with white secretion on median line, intersegmental lines, and lateral margins*; cornicles black and moderately large; legs and antennæ dusky brown shading to black on usual locations; hind tibiæ black for distal two-thirds. Size of body, 3.25 to 4 mm., by 1.80 to 2 mm.; length of hind tibia, 2.50 mm.; length of antenna, 1.25 mm.; ratio of joints: I, 8; II, 10; III, 46; IV, 23; V, 26; VI, 11 plus 5; secondary sensoria, III, 0 to 1; IV, 1 to 2; V, 1; unguis rather heavy and blunt conical. Beak attaining middle of abdomen. Hairs on hind tibia .04 mm., hardly half the diameter of the tibia, set at an angle of about 30 degrees, medium in texture, tending to be spine-like, moderately numerous; hairs on antenna similar but equaling diameter of joint; hairs on body slightly longer, .05 to .07 mm., moderately numerous; hairs on cornicles slightly longer and more numerous than on body. Terminal joints of beak moderately stout, .20, .16, .07 mm., respectively. Cornicles .40 mm. in diameter at base.

Alate Virgogenia (Plate X, 8, and Plate XI, 8, 15). Described from a single example taken on *Apinus flexilis*, Estes Park, Colo., August 16, 1921.

General color: abdomen dark golden brown, head and thorax, cornicles and tip of abdomen, femora, tarsi, knees and distal ends of femora black; antenna mostly dusky, except basal half of joint three;

* Collection taken August 8, 1923, Estes Park, Colo., showed little or no powder but with those areas lighter or greenish in color.

white markings as follows: band across vertex, middle and sides of prothorax, edges of sutures on thorax, entire scutellum, broken median line on abdomen spreading laterally on intersegmental lines, lateral patch on segment 4, and on segments back of cornicles, coalescing and extending to dorso-lateral portion*; stigma, costal and subcostal veins dusky, media dim and twice forked. Length of body, 3.30 mm.; length of hind tibia, 2.50 mm. to 3 mm.; length of antenna 1.33 mm.; ratio of joints I, 10; II, 8; III, 52; IV, 21; V, 26; VI, 13 plus 5; secondary sensoria, III, 8 to 11; IV, 2; V, 1; unguis rather short and blunt-conical; beak as in apterous virgogenia; cornicle .30 mm. in diameter at base. Hairs on middle of hind tibia .06 to .07 mm., hardly exceeding diameter of tibia, set at an angle of 45 degrees, medium in texture and moderately numerous; hairs similar on antennæ and on body; on cornicles slightly longer and more numerous than on body.

Oviparous Female (Plate X, 9, and Plate XI, 12). Described from four examples taken on *Apinus flexilis* in Cherokee Park, Colo., September 6, 1922.

Color and structural characters practically as in apterous virgogenia; hind tibia, 2.25 mm. in length, slightly swollen, bearing many small tuberculate sensoria on almost entire length. Last two or three segments of abdomen heavily covered with white secretion which is rubbed off by means of the hind tibiæ and placed on newly laid eggs.

Male (Plate X, 12, and Plate XI, 11). Described from five examples taken on *Apinus flexilis* in Cherokee Park, Colo., September 2, 1922.

General color-pattern, wings and hairs as in alate virgogenia. Length of body 2.30 mm.; length of hind tibia, 1.50 mm., length of antenna, 1.25 mm.; ratio of joints: I, 8; II, 8; III, 45; IV, 20; V, 26; VI, 11 plus 5; secondary sensoria tuberculate and numerous on joints III, IV and V.

Egg (Plate X, 10 and 11). Laid by above described females.

Color yellowish brown when first laid, later black, lightly covered with white secretion. They are placed end to end on dorsal side of needles.

This species is found feeding on older bark of twigs and branches. The aphid is rather quiet in disposition and may be found in moderately large colonies, and is slow to escape when disturbed.

There seems to be a form with hairs of slightly different character but indistinguishable from type specimens in color

* Collection taken August 8, 1923, did not show powder to an appreciable extent, but showed those areas lighter or greenish.

pattern. The hairs are somewhat finer, more numerous and often twice as long as the types. They occur often in the same localities and on adjacent trees. Whether they ever occur mingled in the same colonies is not certain. Until careful biological work is done on this form, it does not seem justifiable to describe it as distinct, neither does it seem advisable to include it, without question, under *Lachnus apini.*

This species rather closely resembles *Lachnus palmeræ* Gillette on *Picea parryana,* but differs in the tibial hairs, longer and more nearly erect in the latter. Comparison of length of tibial hairs is shown in tabulated form as follows:

	Apterous		Alate	
	Length	Comparison with tibia	Length	Comparison with tibia
L. apini Typical	.04 mm.	Barely one-half the diameter	.06 to .07 mm.	Barely exceeding diameter
Long-haired form	.06 mm.	Over one-half the diameter	.011 mm.	1½ times diameter
L. palmeræ	.15 mm.	1½ to 2 times diameter	.15 mm.	2 times diameter

In *L. palmeræ* the eggs are laid on both bark of twigs and needles, while in *L. pini,* they have been found on needles only.

Collections as follows, all on *Apinus flexilis.*

Fundatrix:
Chambers Lake, Colo., alt. 9,100, June 30, 1923, M. A. Palmer.
Crags, Estes Park, Colo., alt. 8,000, July 4, 1923, M. A. Palmer.
Deer Mt., Estes Park, Colo., alt. 9,000, July 8, 1923, M. A. Palmer.

Apterous Virgogenia:
Estes Park, Loch Vale, Colo., July 21, 1921, C. P. Gillette.
Estes Park, Colo., alt. 8,000, July 21, 1922, C. P. Gillette.
Estes Park, Colo., alt. 8,000, July 23, 1922, C. P. Gillette.
Estes Park, Colo., alt. 8,000, July 22, 1922, M. A. Palmer.
Estes Park, Colo., alt. 8,000, August 5, 1922,* M. A. Palmer.
Estes Park, Colo., alt. 8,000, August 16, 1921, M. A. Palmer.
Cherokee Park, Colo.,† August 27, 1922, M. A. Palmer.
Cherokee Park, Colo., September 2, 1922,* M. A. Palmer.
Estes Park, Colo., October 4, 1922,* M. A. Palmer.
Chambers Lake, Colo., July 12, 1923, M. A. Palmer.
Deer Mt., Estes Park, Colo., July 19, 1923, M. A. Palmer.
Twin Sisters Mt., Estes Park, Colo., August 8, 1923, M. A. Palmer.
Pingree Park, Colo., August 22, 1923, M. A. Palmer.

* Reared in insectary.
† Foothills 50 miles northwest of Fort Collins, Colo.

Alate Virgogenia:
Estes Park, Colo., alt. 9,500, July 26, 1921, M. A. Palmer.
Estes Park, Colo., alt. 8,000, August 16, 1921, M. A. Palmer.
Cherokee Park, Colo.,† September 2, 1922, M. A. Palmer.
Estes Park, Colo., September 14, 1922,* M. A. Palmer.
Cherokee Park, Colo.,† September 22, 1922,* M. A. Palmer.
Estes Park, Colo., alt. 8,000, September 27, 1922,* M. A. Palmer.
Twin Sisters Mt., Estes Park, Colo., alt. 10,000, August 8, 1923, M. A. Palmer.

Apterous Oviparous:
Cherokee Park, Colo.,† September 2, 1922, M. A. Palmer.
Cherokee Park, Colo., September 22, 1922,* M. A. Palmer.
Cherokee Park, Colo., September 29, 1922,* M. A. Palmer.
Cherokee Park, Colo., October 5, 1922,* M. A. Palmer.

Male:
Estes Park, Colo., September 14, 1922,* M. A. Palmer.
Cherokee Park, Colo.,† September 29, 1922,* M. A. Palmer.
Estes Park, Colo., alt. 8,000, October 1, 1922, F. C. Hottes.

Lachnus glabra, n. sp.

Fundatrix (Plate XII, 1, and Plate XIII, 3). Described from a single example taken on *Pinus ponderosa* in foothills near Fort Collins, Colo., May 11, 1918, by L. C. Bragg.

General color same as apterous virgogenia. Length of body, 3 mm.; length of hind tibia, 1.15 mm.; length of antenna, .86 mm.; ratio of joints: I, 8; II, 8; III, 32; IV, 11; V, 13; VI, 13 plus 6; no secondary sensoria. Hairs as in apterous virgogenia.

Apterous Virgogenia (Plate XII, 3, and Plate XIII, 1, 2, 4, 8). Described from three examples taken on *Pinus ponderosa* at Log Cabin, Colo., August 2, 1917, by L. C. Bragg, and two examples taken on same host, Bellevue, Colo., June 15, 1922.

General color dull black or dark olive brown throughout; surface of body everywhere wrinkled, shining on dorsum of head, thorax and 4th to 7th abdominal segments; venter powdery but no powder whatever on dorsum; legs yellowish brown with tarsi, knees and distal portions of tibiæ black; antennæ yellowish with distal portion dusky. Size of body 3 mm. by 2 mm.; length of hind tibia 1.75 mm.; length of antenna 1.10 mm.; ratio of joints: I, 7; II, 8; III, 44; IV, 17; V, 18; VI, 14 plus 7; secondary sensoria, none; unguis heavy, finger-like and long; hairs short, rather sparse, on hind tibia, .03 to .05 mm. in length, equaling half of diameter of tibia, fine, set at an angle of 45 degrees, occasional hairs nearly erect; hairs on antenna similar and equaling diameter of joint; hairs on body minute, .01 to .02 mm. long, fine and sparse; hairs on cornicles longer and more closely set

* Reared in insectary.

† Foothills 50 miles northwest of Fort Collins, Colo.

‡ Six examples taken August 15, 1921, in Estes Park, Colo., were dusky olive brown on abdomen, pale sordid greenish on thorax and head. They were perhaps quite fresh adults.

than on body; beak attaining 7th abdominal segment, terminal joints slender, .24, .30, and .11 mm. in length, respectively; cornicles small, .20 mm. in diameter at base, vertex inclined to be rather pointed, giving a bug-like appearance to the insect.

Young, (Plate XII, 4).

1st instar: General color: colorless except posterior portion of abdomen which is yellowish brown fading out anteriorly on 2d abdominal segment; legs and antennæ colorless throughout. Beak slightly surpassing tip of abdomen.

Alate Virgogenia (Plate XII, 2, and Plate XIII, 5, 7). Described from two examples taken on *Pinus ponderosa* in foothills near Fort Collins, June 25, 1921.

General color: abdomen dusky green to dark golden brown; head, thorax and cornicles black; entire legs black except pale yellow ring on 1st and 2d pair of tibiæ; antennæ with entire 1st, 2d and 6th, and distal ends of 3d, 4th and 5th joints black. No white markings whatever on dorsum. Length of body, 2.50 mm.; length of hind tibia, 1.50 mm.; length of antenna, 1.05 mm.; ratio of joints, I, 8; II, 8; III, 39; IV, 14; V, 17; VI, 14 plus 8; secondary sensoria, III, 4; IV, 0; V, 0; sensoria flat, not tuberculate, and irregular in size, located on distal half; unguis long, finger-like, heavy; hairs, fine, rather short, .05 mm. long, set at an angle of 45 degrees, fairly numerous; hairs on antennæ similar, but equalling diameter of antenna; hairs on body shorter, mostly minute, .01 to .02 mm. in length and sparse; hairs on cornicles but slightly longer, few in number; beak attaining posterior portion of abdomen; wings slightly smoky, stigma, costal cell and stigmal vein dusky, media faint, twice forked; cornicles small, .15 mm. in diameter at base.

Oviparous Female (Plate XIII, 9). Described from seven examples taken on *Pinus ponderosa* in foothills near Bellevue, Colo., October 2, 1921, by J. L. Hoerner.

General color and structural characters as in apterous virgogenia; hind tibia not perceptibly swollen, but covered nearly from end to end with numerous flat, not tuberculate, sensoria.

Male (Plate XII, 5, and Plate XIII, 6). Described from a single example in same collection as oviparous female above.

General color as in alate virgogenia; length of body 2 mm.; length of hind tibia, 1.20 mm.; length of antenna, 1 mm.; ratio of joints practically as in alate virgogenia; secondary sensoria, tuberculate and numerous on joints III, IV and V; unguis and hairs as in alate virgogenia.

Males taken September 10, 1922, and August 15, 1921, bear erect hairs on tibiæ, but agree in other respects. Since

there is a tendency for some hairs to be more or less erect even in specimens with drooping hairs, it seems possible that these are not specifically distinct.

Collections as follows, all on *Pinus ponderosa:*

Fundatrix:
Fort Collins, Colo., May 11, 1918, L. C. Bragg.

Apterous Virgogenia:
Livermore, Colo., alt. 8,000, May 25, 1918, L. C. Bragg.
Fort Collins, Colo., alt. 5,000, June 25, 1921, M. A. Palmer.
Fort Collins, Colo., alt. 8,000, June 15, 1922, M. A. Palmer.
Estes Park, Colo., alt. 8,000, July 23, 1922, C. P. Gillette.
Estes Park, Colo., alt. 8,000, July 31, 1921, M. A. Palmer.
Fort Collins, Colo., alt. 6,000, August 1, 1922, C. P. Gillette.
Estes Park, Colo., alt. 8,000, August 15, 1921, M. A. Palmer.
Fort Collins, Colo., alt. 8,000, August 21, 1922, C. A. Bjurman.

Alate Virgogenia:
Fort Collins, Colo., June 25, 1921, M. A. Palmer.
Fort Collins, Colo., alt. 8,000, August 20, 1922, M. A. Palmer.

Oviparous Female:
Fort Collins, Colo., alt. 8,000, October 2, 1921, J. L. Hoerner.
Fort Collins, Colo., alt. 8,000, October 9, 1921, J. L. Hoerner and C. L. Corkins.
Fort Collins, Colo., October 13, 1910, L. C. Bragg.
Big Thompson, Colo., October 22, 1921, M. A. Palmer.

Male:
Estes Park, Colo., alt. 8,000, August 15, 1921, M. A. Palmer.
Fort Collins, Colo., alt. 8,000, October 2, 1921, J. L. Hoerner.

Lachnus ater, n. sp.

Apterous Virgogenia (Plate XII, 6, and Plate XIII, 10). Described from a few examples taken on *Pinus edulis*, Owl Canon, Larimer County, Colo., September 25, 1921, and many taken from same host and locality August 6, 1922, by F. C. Hottes and C. A. Bjurman.

General color, polished dark brown to jet black, with no powder whatever on dorsum; legs quite dark throughout in older individuals, middle portion of tibiæ yellowish in young adults; antenna dusky to black excepting basal portion of joints 3, 4 and 5. Size of body 2.50 by 1.50 mm.; length of hind tibia 1.30 to 1.75 mm.; length of antenna 1.05 mm.; ratio of joints: I, 7; II, 7; III, 35; IV, 15; V, 20; VI, 10 plus 4; secondary sensoria, III, 0; IV, 0 to 1; V, 1; unguis short conical, 6th joint heavy; beak equalling or exceeding body in length; terminal joints rather stout; .20, .17, .07 mm. long, respectively; cornicle .25 to .30 mm. in diameter at base; hairs on outer side of middle of hind tibia short, .04 to .06 mm. in length, less than the diameter of the tibia, drooping, rather sparse, and fine, somewhat longer on inside of tibia; hairs on antenna short, .03 mm. long, less than diameter of joint, drooping; hairs on body very short, .01 to .02 mm. long, and sparse, hairs on cornicles similar to body.

Alate Virgogenia (Plate XII, 7, and Plate XIII, 11, 15, 16, 17). Described from 37 examples taken on *Pinus edulis*, Owl Canon, Larimer County, Colo., August 6, 1922, by F. C. Hottes and C. A. Bjurman.

General color; shining brownish black to deep black, without pulverulence; legs black with proximal ends of femora, and section of tibia below knees pale yellowish; antennæ black with proximal ends of joints 3, 4 and 5 yellowish; wings slightly smoky with stigma, costal and subcostal veins black, media faint. Length of body 3 mm.; length of hind tibia, 1.80 mm.; length of antenna, 1.05 mm.; ratio of joints: I, 8; II, 8; III, 38; IV, 17; V, 23; VI, 10 plus 4; secondary sensoria, III, 4 to 7; IV, 1 to 2; V, 1; VI, 11 plus 4; unguis short and broadly conical; 6th joint thick, decidedly exceeding diameter of other joints. Cornicles .25 mm. in diameter at base. Beak attaining cornicles, terminal joints stout, measuring .18, .15, .07 mm., respectively. Media variable, sometimes once forked and sometimes twice forked. In 31 individuals 7 showed both wings twice forked; 11, once forked, and 13 showed one wing once forked and one twice forked. Hind wing with both cross veins present. Hairs on hind tibia rather short, .06 to .09 mm., equalling or times 1½ diameter of tibia, drooping, set at angle of about 30 degrees, medium in texture, moderately numerous, rather sparse and shorter on outer side of proximal third of tibia, somewhat longer and more numerous on inner side of entire tibia; hairs on antenna short, .04 mm. long, equalling diameter of joint, set at angle of about 30 degrees, medium in texture and not numerous; hairs on body very fine, short and sparse; on cornicles slightly longer but very few in number.

Young:

1st instar: before feeding, orange yellow, mottled with green; legs pale with dusky on usual locations. After feeding, shading into olive brown, then to shining reddish brown.

Oviparous Female (Plate XII, 8, and Plate XIII, 13, 14). Described from a few examples taken on *Pinus edulis*, in Owl Canon, Larimer County, Colo., October 27, 1921.

General color, size and structural characters as in apterous virgogenia. Hind tibia with a few dim, irregular and flat sensoria. The specimens had the appearance of being immature, but eggs were found, so this may be the normal appearance of this form.

Apterous Male (Plate XII, 10, and Plate XIII, 12). Described from a single specimen taken along with above females.

General color, same as female. Size, 1.25 by .50 mm.; length of hind tibia, 1.15 mm.; length of antenna, .80 mm.; ratio of joints: I, 6; II, 6; III, 32; IV, 14; V, 21; VI, 10 plus 4; secondary sensoria, III, 4; IV, 5; V, 6; all located on posterior edge of antenna.

This species was found in small colonies or solitary, attended by numerous small ants, from which it was distinguished only by close observation. Found feeding on the smooth bark on the underside of small limbs.

Collections as follows, all on *Pinus edulis:*

Apterous Virgogenia:

Owl Canon, Larimer County, Colo.,* August 6, 1922, F. C. Hottes and C. A. Bjurman.
Owl Canon, Larimer County, Colo.,† September 6, 1922 , M. A. Palmer.
Owl Canon, Larimer County, Colo.,† September 24, 1922, F. C. Hottes.
Owl Canon, Larimer County, Colo.,† September 25, 1921, C. P. Gillette and M. A. Palmer.
Owl Canon, Larimer County, Colo.,* October 19, 1922, M. A. Palmer.

Alate Virgogenia:

Owl Canon, Larimer County, Colo., August 6, 1922, F. C. Hottes and C. A. Bjurman.

Oviparous Females:

Owl Canon, Larimer County, Colo., October 27, 1921, C. L. Corkins and M. A. Palmer.
Owl Canon, Larimer County, Colo., November 6, 1921, J. L. Hoerner.

Lachnus ponderosæ‡ Williams.

Egg: Black, shining, laid in rows along the needles; size, 1 mm. by .47 mm., open end of hatched eggs always toward tip of needle. Described from eggs taken on *Pinus ponderosa* in foothills near Fort Collins, Colo., by C. A. Bjurman.

Young Fundatrix.

1st instar: General color very dark dusky brown, in a few hours covered by very fine powder giving a slaty or gray color; legs and antennæ very dark dusky to black. Beak extending well beyond the tip of the abdomen.

2d instar: With a gray pattern on a lighter background of general body color.

Later instars: Resembling adult in yellowish brown body color and arrangement of powdery secretion.

As soon as hatched, these lice go to bark at base of needles to insert their beaks.

Oviparous Female, (Plate I, 4). Described from 12 examples taken on *Pinus ponderosa* in Owl Canon, Larimer County, Colorado, October 27, 1921.

Same in color pattern as apterous virgogenia except that seventh and eighth abdominal segments are covered with powdery secretion. This secretion seems to be spread but lightly as a covering for the eggs,

* Foothills 20 miles northwest of Fort Collins, Colo.
† Reared in insectary, Fort Collins, Colo.
‡ Description of the other forms published in ANNALS, Vol. X, 1917, p. 142.

as they show but little when fresh and in the spring they may appear shining. The hind tibia was figured in ANNALS of the Ent. Soc. of Am., 1917, p. 142, Pl. XI, Fig. 43.

Collections as follows, all on *Pinus ponderosa:*

Fort Collins, Colo., November 25, 1909, M. A. Palmer.
Fort Collins, Colo., October 9, 1917, L. C. Bragg.
Owl Canon, Laramie County, Colo., October 27, 1921, M. A. Palmer.

Lachnus pulverulens, n. sp.

Apterous Virgogenia (Text Figure I, 1, and Text Figure II, 3, 4, 5, 7). Described from seven examples taken on *Sabina scopulorum*, Big Thompson Canon, Colo., September 30, 1923,

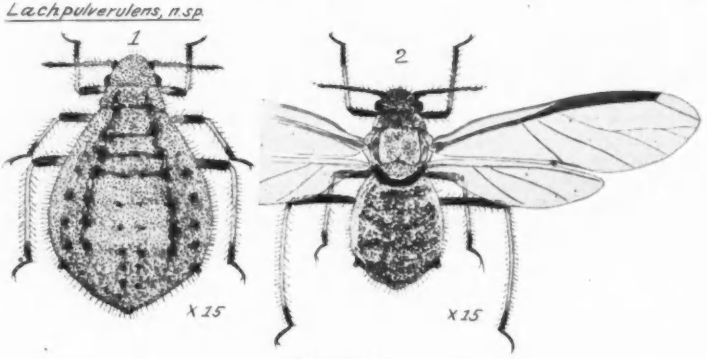


FIGURE I.

Lachnus pulverulens, n. sp. 1, apterous virgogenia; 2, alate virgogenia.

and two examples taken on same host in foothills near Fort Collins, Colo., August 1, 1909, on bark of little limbs without ants.

General color, yellowish-brown with 2 longitudinal rows of dark brown or blackish areas, vanishing about the middle of abdomen, also 2 median rows of black dots; cornicles black; antennæ pale yellowish except 1st and 2d joints and tip which are black, tips of other joints but slightly dusky; legs pale yellow with most of femora, tips of tibiæ, knees and entire tarsi black; covered on entire dorsum and venter with heavy powdery secretion, excepting on dark areas, sometimes nearly obliterating even these. Body rather robust, 2.90 mm. in length by 1.60 mm. in width; hind tibia 1.20–1.40 mm., straight or slightly curved; antenna .95 mm.; ratio of joints: I, 10; II, 10; III, 32; IV, 14; V, 16; VI, 11 plus 2; secondary sensoria as follows: III,

0–1, very small; IV, 1 small; V, 1; unguis very short, conical. Hairs on hind tibia, fine, moderately long, .08 to .10 mm., equal to or slightly exceeding diameter of tibia, rather numerous, erect; hairs on antenna about the same as on tibia, .10 mm., twice the diameter of joint; hairs on body same as tibia; cornicles very small, .15 mm. in diameter at base; beak attaining cornicles in length; joints .17, .14, .07 mm. respectively, moderately stout.

Alate Virgogenia (Text Figure I, 2, and Text Figure II, 6). Described from a single example taken on *Sabina scopulorum*, August 1, 1909, in foothills near Fort Collins, Colo., on bark of little limb.

General color, yellowish brown throughout, covered everywhere with heavy white powder; legs pale except femora which are brown, and tips of tibiæ and entire tarsi, which are black; cornicles black; antennæ as in apterous. Length of body, 2 mm.; hind tibia, .90 mm.;

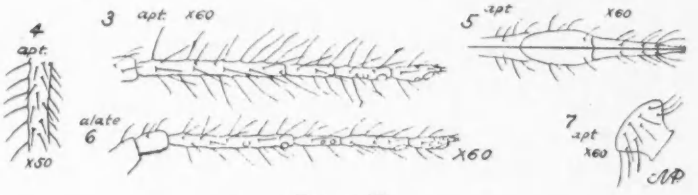


FIGURE II.

Lachnus pulverulens, n. sp. 3, antenna of apterous virgogenia; 4, middle of hind tibia of apterous virgogenia (same as alate); 5, beak of apterous virgogenia; 6, antenna of alate virgogenia; 7, cornicle of apterous virgogenia.

antenna, .80 mm.; ratio of joints: I, 7; II, 7; III, 30; IV, 12; V, 16; VI, 10 plus 1; secondary sensoria as follows: III, 2 to 3; IV, 1 to 2; V, 1; unguis very short conical; hairs as in apterous; wings hyaline; media twice-branched.

Oviparous Female. Described from three examples taken on *Sabina scopulorum*, September 30, 1923, Big Thompson Canon, Colo., and three others October 17, 1923, reared in insectary from same lot.

General color and structural characters same as apterous virgogenia, excepting the hind tibiæ, which are dark throughout, decidedly thickened, and showing faint sensoria scattered along practically the entire length.

This species is found on bark of little twigs anywhere from base to near tip.

EXPLANATION OF PLATES.

PLATE I.

Anoecia graminis, n. sp. 1, apterous virgogenia.

Anoecia setariæ, n. sp. 2, apterous virgogenia; 3, alate virgogenia.

Lachnus ponderosæ Williams. 4, oviparous female.

Essigella hoerneri, n. sp. 5, apterous virgogenia; 6, oviparous female and egg.

Essigella fusca, n. sp. 7, oviparous female; 8, male; 9, apterous virgogenia, 10, young; 11, alate virgogenia.

PLATE II.

Anoecia setariæ, n. sp. 1, antenna of apterous virgogenia; 2, antenna of alate virgogenia; 3, beak; 4, cornicle.

Anoecia graminis, n. sp. 5, antennæ of alate virgogenia; 6, antenna of apterous virgogenia; 7, antenna of oviparous female; 8, beak of apterous virgogenia; 9, cornicle; 10, wax gland or tubercle on abdomen; 11, wings; 12, lateral hair of apterous virgogenia; 13, middle of hind tibia of alate virgogenia; 14, tarsus.

Essigella hoerneri, n. sp. 15, middle of hind tibia of apterous virgogenia; 16, beak of apterous virgogenia; 17, cornicle of apterous virgogenia; 18, antenna of apterous virgogenia; 19, hind tibia of oviparous female.

Essigella fusca, n. sp. 20, antenna of apterous virgogenia; 21, tarsus of apterous virgogenia; 22, beak; 23, antenna of alate virgogenia; 23a, middle of hind tibia of alate virgogenia (practically the same as apterous); 24, antenna of apterous male; 25, hind tibia of oviparous female.

PLATE III.

Lachnus sabinæ, n. sp. 1, apterous virgogenia; 2, young, second generation virgogenia, a few days old; 3, oviparous female; 4, alate virgogenia; 5, alate male; 6, egg.

Lachnus sibericæ, n. sp. 7, fundatrix; 8, apterous virgogenia; 9, oviparous female; 10, alate virgogenia; 11, egg; 12, male.

PLATE IV.

Lachnus sibericæ, n. sp. 1, antenna of apterous virgogenia; 2, antenna of alate virgogenia; 2a, beak; 3, antenna of oviparous female; 4, middle of hind tibia of apterous virgogenia; 5, middle of hind tibia of alate virgogenia; 6, hind tibia of oviparous female; 7, cornicle of alate virgogenia; 8, cornicle of apterous virgogenia; 9, antenna of male.

Lachnus sabinæ, n. sp. 10, antenna of fundatrix; 11, antenna of apterous virgogenia; 12, middle of hind tibia of apterous virgogenia (same as alate); 13, antenna of alate virgogenia; 14, antenna of male; 15, antenna of oviparous female; 16, hind tibia of oviparous female; 17, cornicle of alate virgogenia; 18, beak.

PLATE V.

Lachnus splendens, n. sp. 1, fundatrix; 2, young second generation, first instar after feeding; 3, two-thirds grown apterous virgogenia; 4, immature apterous virgogenia; 5, mature apterous virgogenia; 6, alate virogenia; 7, oviparous female; 8, freshly laid egg; 9, alate male.

PLATE VI.

Lachnus solitarius, n. sp. 1, apterous virgogenia; 2, alate virgogenia; 3, young.

Lachnus terminalis, n. sp. 4, apterous virgogenia; 5, alate virgogenia; 6, oviparous female; 7, alate male.

Lachnus hottesi, n. sp. 8, apterous virgogenia; 9, alate virgogenia.

PLATE VII.

Lachnus splendens, n. sp. 1, antenna of apterous virgogenia; 2, antenna of alate virgogenia; 3, cornicle of alate; 4, hairs on middle of hind tibia of alate virgogenia; 5, beak; 6, antenna of male; 7, tibia of oviparous female.

Lachnus hottesi, n. sp. 8, beak of apterous virgogenia; 9 cornicle; 10, middle of hind tibia of apterous virgogenia; 11, middle of hind tibia of alate virgogenia; 12, antenna of alate virgogenia; 13, antenna of apterous virgogenia.

Lachnus terminalis, n. sp. 15, antenna of apterous virgogenia; 16, beak of apterous virgogenia; 17, antenna of alate virgogenia; 18, antenna of male; 19, tibia of oviparous female; 20, cornicle of apterous virgogenia; 21, hairs on middle of hind tibia of alate virgogenia; 22, hairs on middle of hind tibia of apterous virgogenia.

PLATE VIII.

Lachnus similis, n. sp. 1, fundatrix; 2, alate virgogenia, second generation; 3, young third generation; 4, male; 5, oviparous female; 6, egg, freshly laid.

Lachnus brevispinosus, n. sp. 7, apterous virgogenia, third generation; 8, alate virgogenia; 9, young, fourth generation; 10, oviparous female; 11, male.

PLATE IX.

Lachnus murrayanæ, n. sp. 1, antenna of alate virgogenia; 2, antenna of apterous virgogenia; 3, hind tibia of oviparous female; 4, middle of hind tibia of alate virgogenia; 5, antenna of male.

Lachnus similis, n. sp. 6, antenna of alate virgogenia; 7, middle of hind tibia of alate virgogenia; 8, beak; 9, antenna of male; 10, antenna of oviparous female; 11, hind tibia of oviparous female; 12, cornicle of apterous virgogenia.

Lachnus brevispinosus, n. sp. 13, antenna of alate virgogenia; 14, middle of hind tibia of alate virgogenia; 15, beak of apterous virgogenia; 16, first five joints of antenna of male; 17, antenna of oviparous female; 18, cornicle of same; 19, hind tibia of oviparous female.

PLATE X.

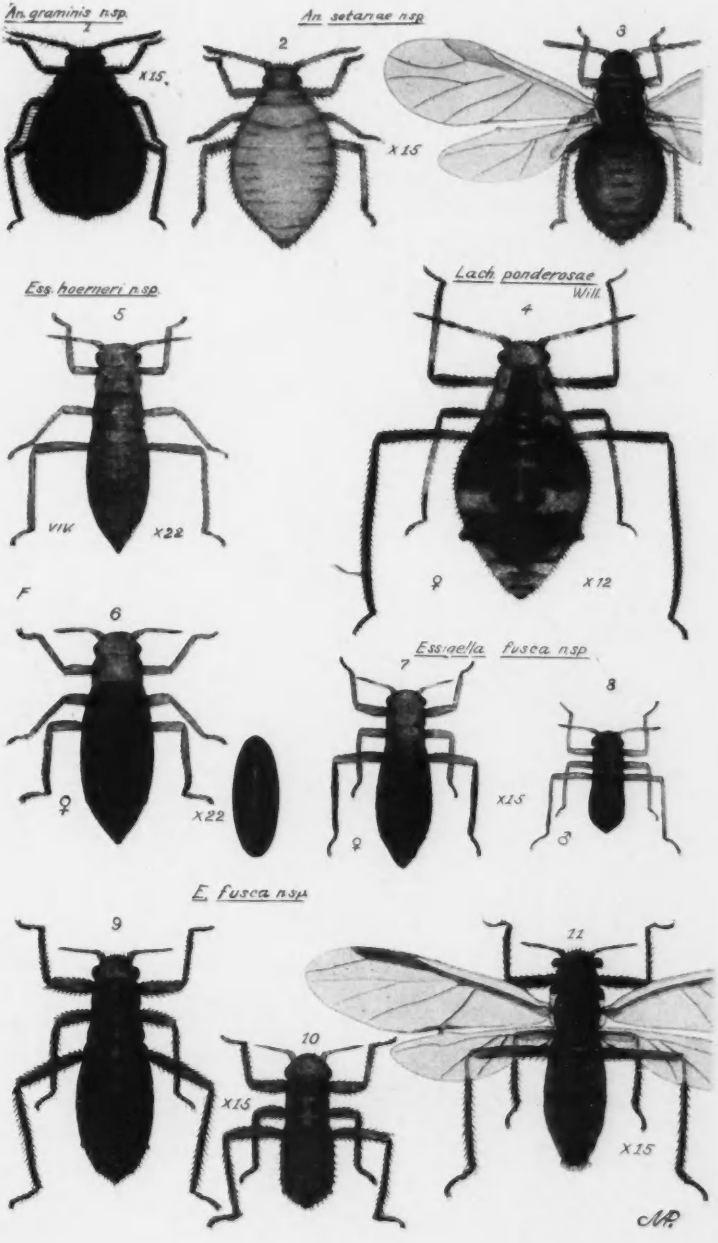
Lachnus flexilis, n. sp. 1, apterous virgogenia; 2, alate virgogenia; 3, young virgogenia, 1st instar; 4, oviparous female; 5, egg.

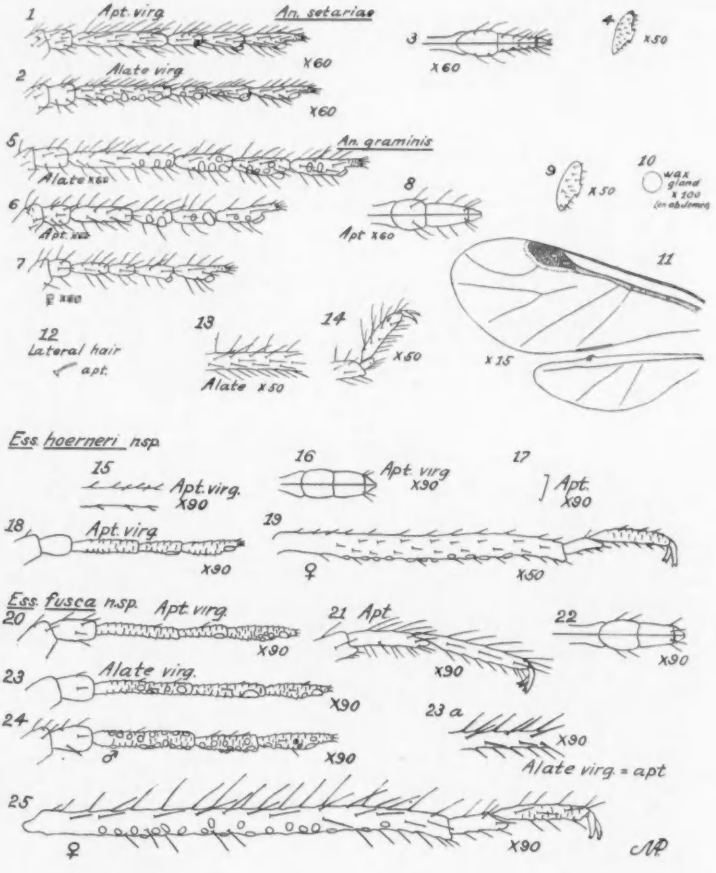
Lachnus apini, n. sp. 6, young virgogenia, second instar; 7, apterous virgogenia; 8, alate virgogenia; 9, oviparous female; 10, egg; 11 freshly laid egg; 12, male.

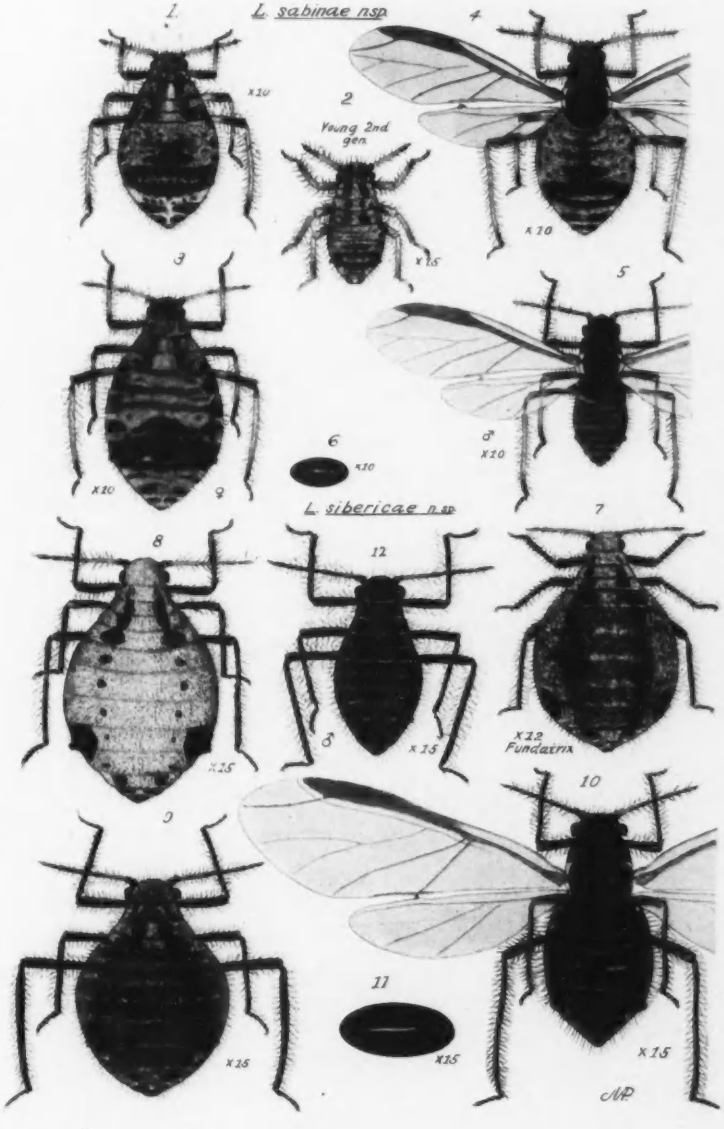
PLATE XI.

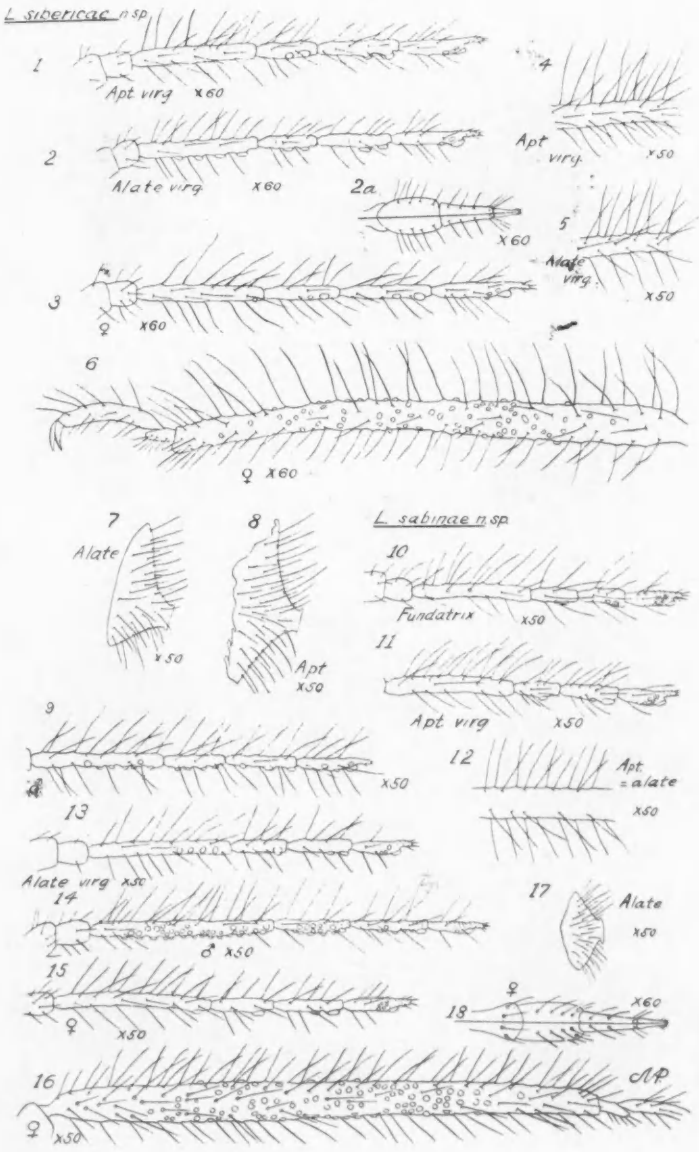
Lachnus flexilis, n. sp. 1, antenna of apterous virgogenia; 2, antenna of alate virgogenia; 3, tibia of oviparous female; 4, body hairs of apterous virgogenia; 5, middle of hind tibia of apterous virgogenia (same as alate); 6, cornicle of alate virgogenia; 7, beak.

Lachnus apini, n. sp. 8, antenna of alate virgogenia; 9, antenna of apterous virgogenia; 10, beak of apterous virgogenia; 11, antenna of male; 12, tibia of oviparous female; 13, cornicle; 14, middle of hind tibia of apterous virgogenia; 15, middle of hind tibia of alate virgogenia.


An. graminis n.sp.
1
X15.
An. setariae n.sp.
2
X15
3
Ess. hoerneri n.sp.
5
VIII
X22
Lach. ponderosae Will.
4
♀
X12
F
6
♀
X22
Essigella fusca n.sp.
7
♀
X15
8
♂
E. fusca n.sp.
9
X15
10
11
X15
MP


1 Apt. virg. An. setariae
x60
2 Alate virg
x60
3
x60
4
x50
5 An. graminis
Alate x60
6
Apt. x60
7
x60
8
Apt x60
9
x50
10 wax gland x100 (on abdomen)
11
x15
12 Lateral hair
apt.
13
Alate x50
14
x50
Ess. hoerneri n.sp.
15 Apt. virg.
x90
16 Apt. virg
x90
17 Apt.
x90
18 Apt. virg
x90
19
x50
Ess. fusca n.sp. Apt. virg.
20
x90
21 Apt.
x90
22
x90
23 Alate virg.
x90
24
x90
23 a
x90
Alate virg. = apt.
25
x90


L. sabinae nsp
1
x10
2
Young 2nd gen.
x15
3
x10
♀
4
x10
5
♂
x10
6
x10
L. sibericae n.sp
7
x12
Fundatrix
8
x25
♀
9
x15
10
x15
11
x15
12
♂
x15
MP



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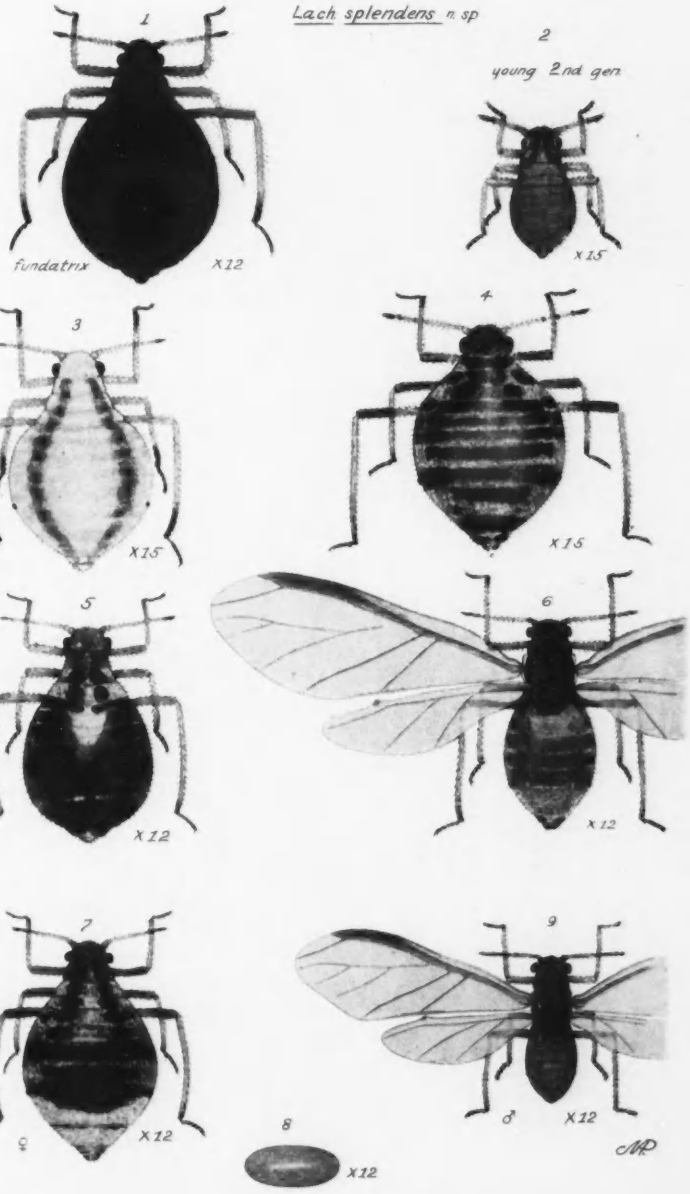

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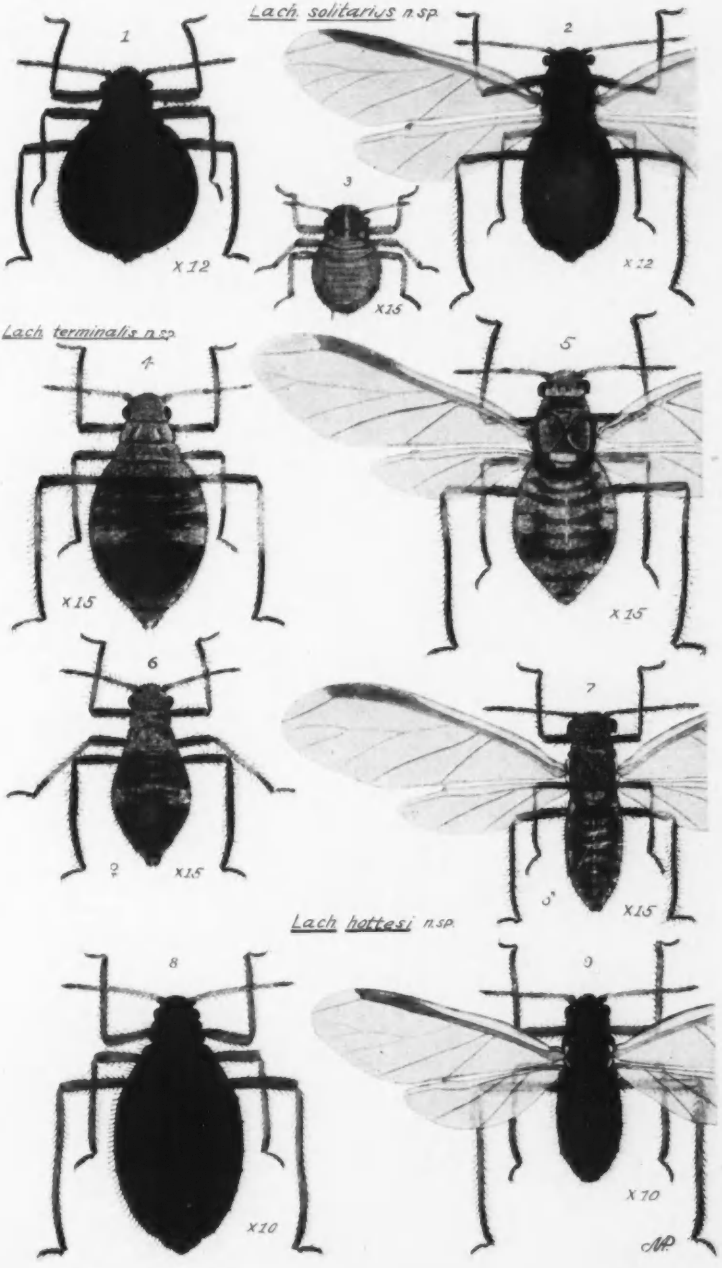

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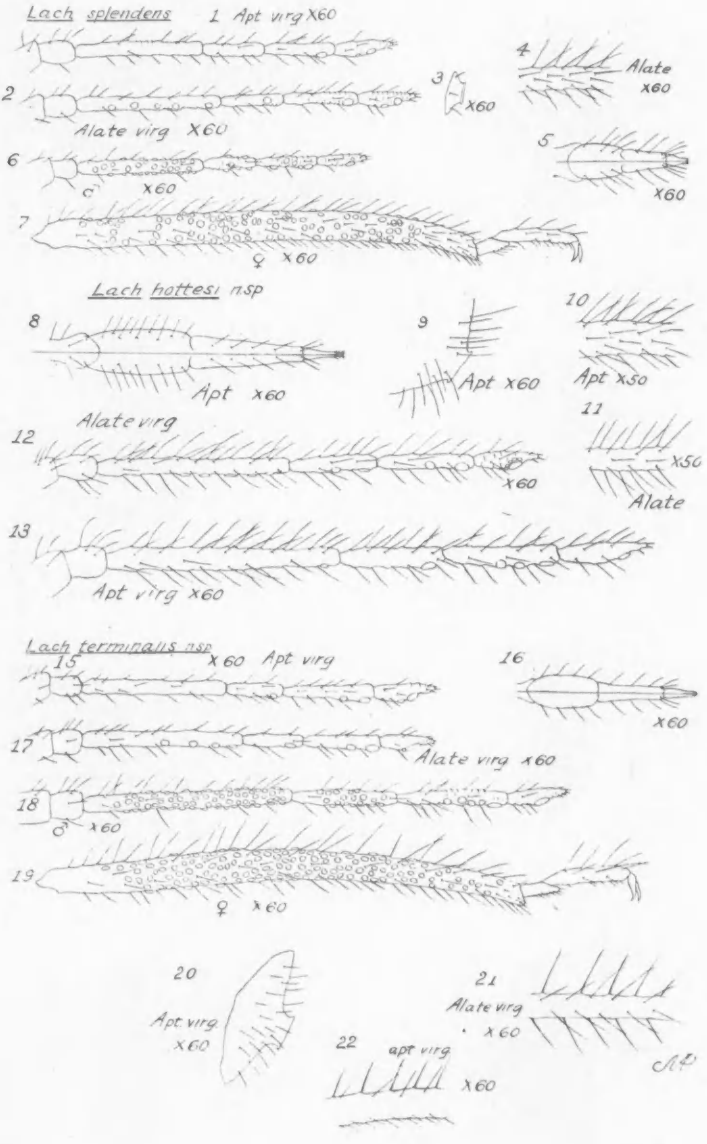

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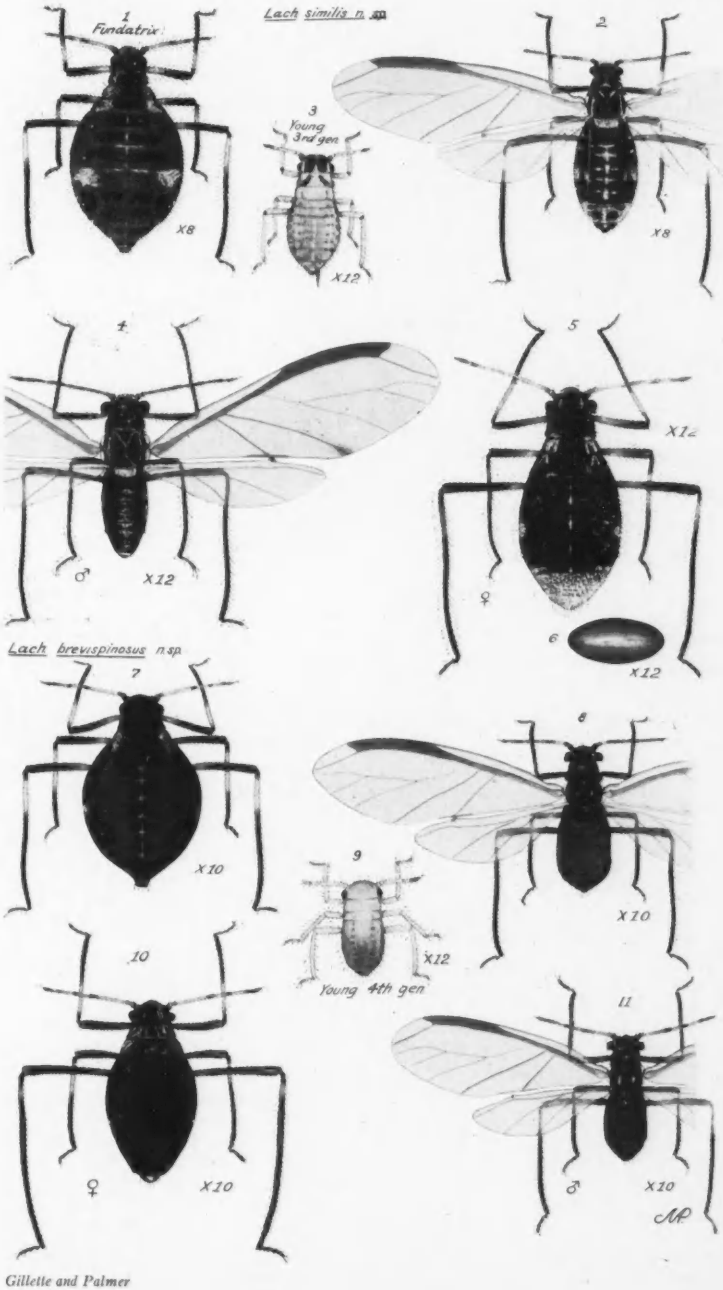

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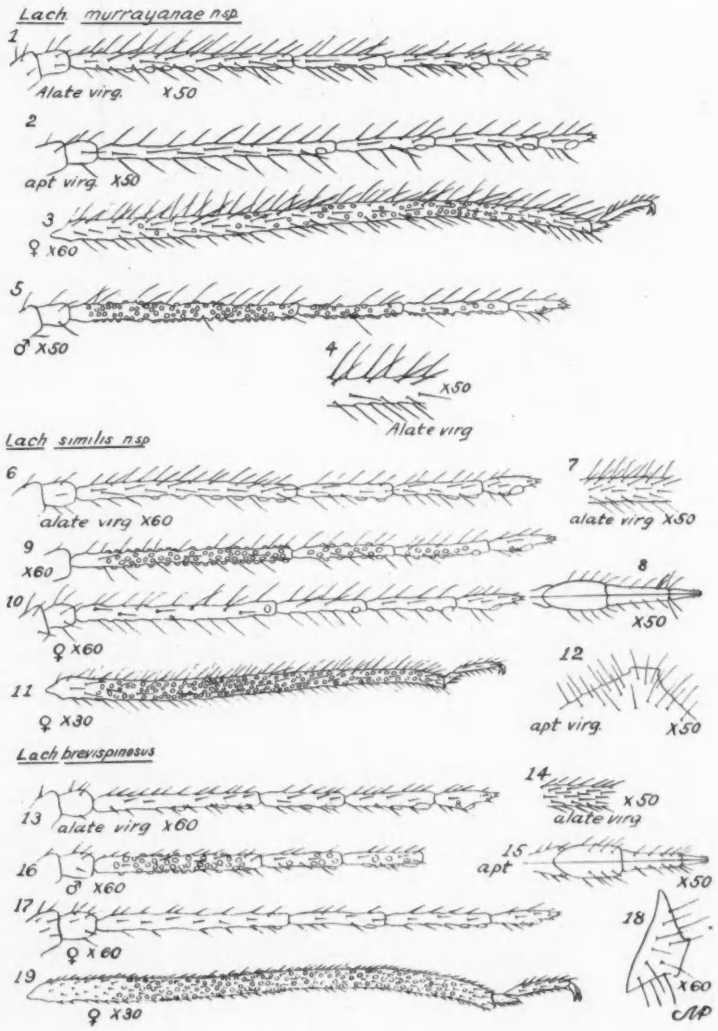
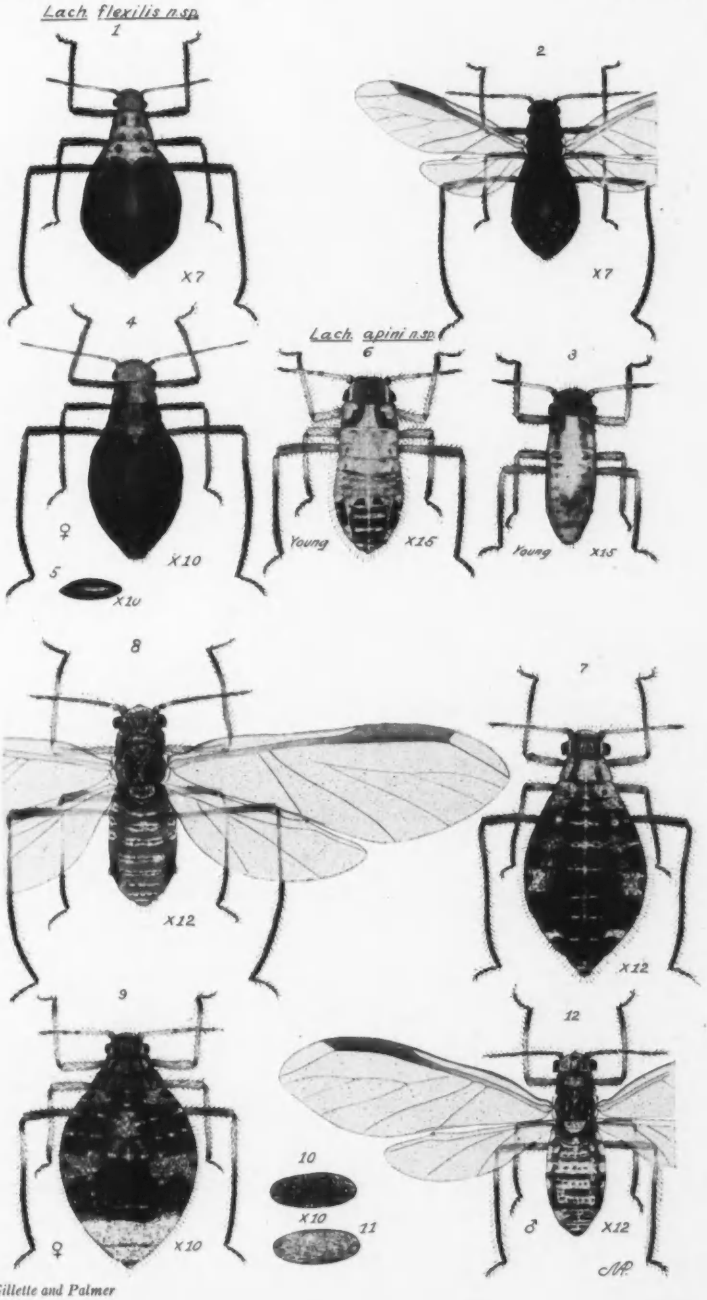

Lach. murrayanae nsp
1
Alate virg. X50
2
apt virg. X50
3
♀ X60
5
♂ X50
4
X50
Alate virg
Lach similis nsp
6
alate virg X60
7
alate virg X50
9
X60
8
10
X50
♀ X60
12
11
apt virg. X50
♀ X30
Lach brevispinosus
14
X50
13
alate virg
alate virg X60
15
apt
16
X50
♂ X60
17
♀ X60
18
X60
19
♀ X30



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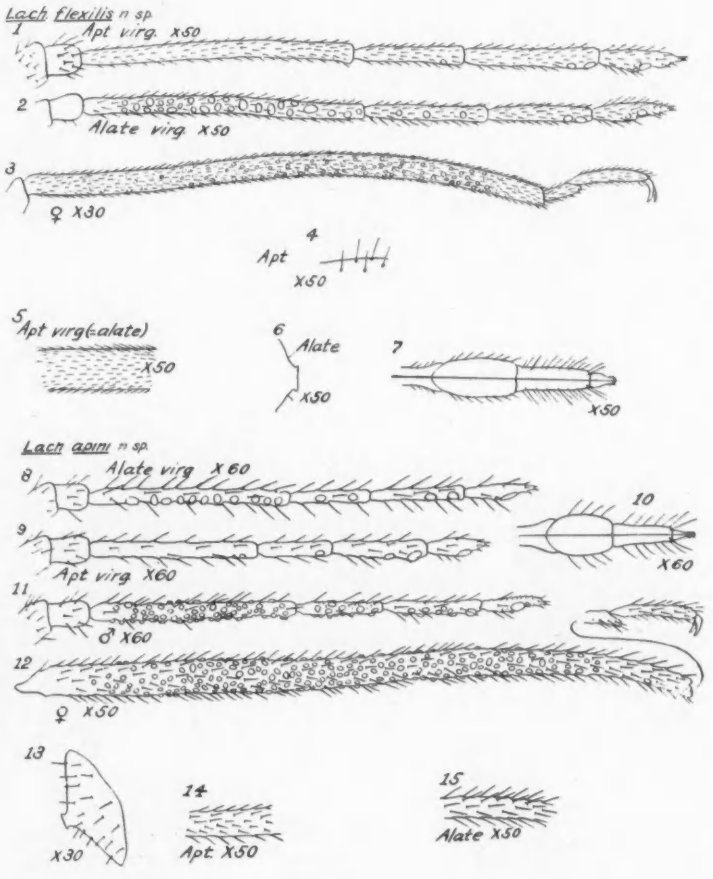
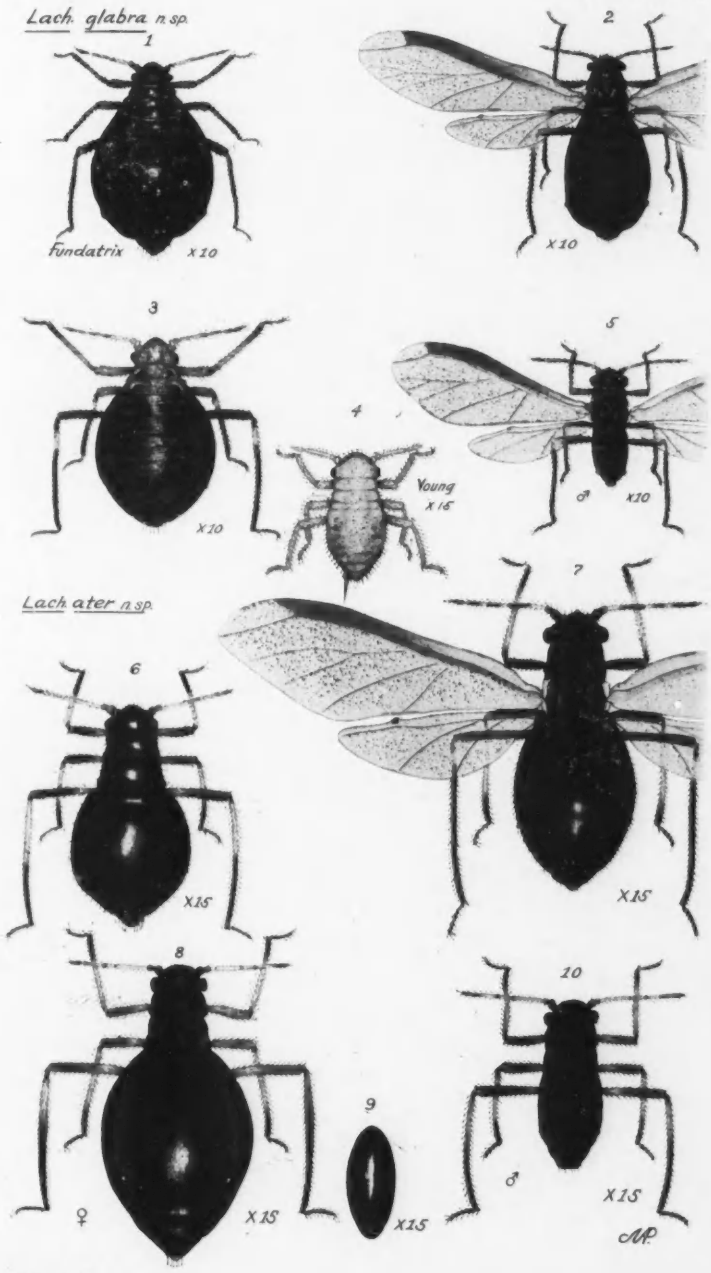

Lach. flexilis n sp.
1
Apt virg. X50
2
Alate virg. X50
3
♀ X30
4
Apt
X50
5
Apt virg(-alate)
X50
6
Alate
X50
7
X50
Lach. apini n sp.
8
Alate virg X60
9
Apt virg X60
10
X60
11
♂ X60
12
♀ X50
13
X30
14
Apt X50
15
Alate X50



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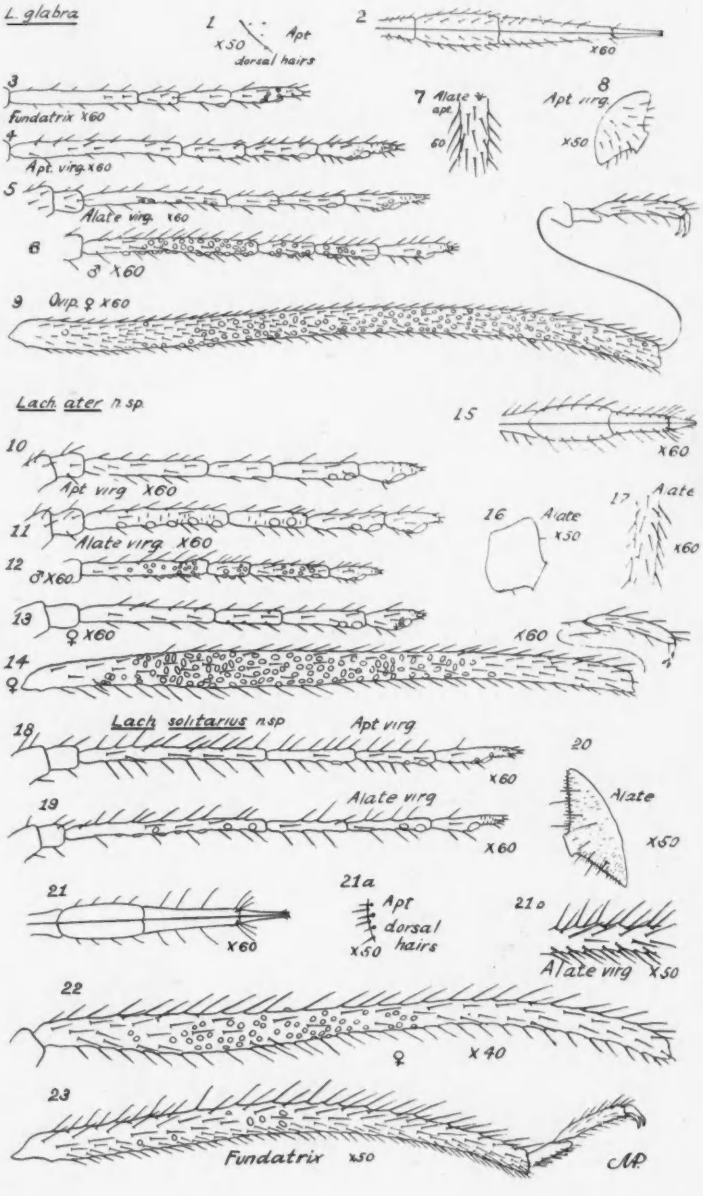

Gillette and Palmer

UNDESCRIBED SPECIES OF JAPANESE CRANE FLIES

PART IV.*

CHARLES P. ALEXANDER,
Massachusetts Agricultural College.

The preceding parts under this general title were published in these ANNALS in 1919, 1921 and 1923. The species described at this time were included in extensive collections from Taiwan, taken by Messrs. Esaki and Takeuchi; from the island of Okinawa in the Loochoos, collected by Mr. Sakaguchi; and from various parts of Honshiu, collected by Messrs. Esaki, Machida and Takahashi. I would express my sincere thanks to all the above entomologists for the privilege of retaining this very valuable collection.

In these ANNALS in 1920, the writer presented a Bibliography of the literature concerning the Tipuloidean fauna of Taiwan (Formosa). A number of additional papers have recently appeared and these are listed herewith:

Alexander, C. P. New or Little-Known Crane-Flies from Formosa (Tipulidæ, Diptera); Ann. Ent. Soc. Amer., 13:249-270, 1920.

Alexander, C. P. Four Undescribed Species of Limnobia from the Oriental Region (Diptera, Tipulidæ); Insec. Inscit. Menst., 10:75-80, 1922.

Alexander, C. P. Undescribed Species of Japanese Crane-Flies (Tipulidæ, Diptera). Part III; Ann. Ent. Soc. Amer., 16:57-76, 1923.

Alexander, C. P. Undescribed Crane-Flies from Formosa and Luzon (Tipulidæ, Diptera); Philippine Journ. Sci., 22:467-481, 1923.

Edwards, F. W. The Old-World Species of Eriocera in the British Museum Collection (Diptera, Tipulidæ); Ann. Mag. Nat. Hist., (9), 8:67-99, pl. 10, figs. 1-12, 1921.

Edwards, F. W. New and Little-Known Tipulidæ, Chiefly from Formosa. Part II; Ann. Mag. Nat. Hist., (9), 8:99-115, pl. 10, figs. 13-19, 1921.

Enderlein, Gunther. Dipterologische Studien XVII; Zool. Anzeig., 52:219-232, 1921.

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* Contribution from the Department of Entomology, Massachusetts Agricultural College.

Geranomyia Haliday.

Geranomyia (Geranomyia) **sakaguchii,** sp. n.

Size large (wing over 9 mm.); pleura heavily striped longitudinally with brownish black; wings tinged with gray, the costal region more yellowish, the disk spotted; Sc_1 ending shortly beyond the origin of *Rs*.

Male. Length (excluding rostrum) 7.2 mm.; wing 9.4 mm.; rostrum alone 1.6 mm. *Female*. Length (excluding rostrum) 8.6 mm.; wing 10 mm.; rostrum alone 2 mm.

Rostrum relatively short, black, the apex obscure yellow; palpi black. Antennæ black throughout, the flagellar segments slightly produced in the male, oval in the female. Head black, sparsely pruinose.

Pronotum dark brown. Mesonotal præscutum obscure yellow, with three brown stripes, the extreme lateral margin of the sclerite a little darkened; scutal lobes darkened; scutellum brownish testaceous; postnotum with the mediotergite brownish testaceous, the lateral margin blackened. Propleura yellowish. Mesopleura silvery testaceous, with two conspicuous brownish black stripes, the more dorsal one broader, beginning on the fore coxæ, traversing the dorsal pleurites, crossing the postnotal pleurotergite onto the extreme margin of the mediotergite; the ventral stripe is narrow, traversing the mesosternum, passing above the coxæ and beneath the halteres to the abdomen. Halteres pale yellow. Legs with the coxæ greenish testaceous, the base of the fore coxæ dark brown; trochanters greenish testaceous; femora obscure yellow with a narrow and relatively ill-defined brown ring immediately before the tips; tibiæ obscure yellow, the tips faintly darkened; terminal tarsal segments infuscated. Wings tinged with gray, the costal region yellowish; rather small but conspicuous brown spots at arculus; at the supernumerary crossvein in cell *Sc;* at tip of *Sc* and origin of *Rs;* at fork of *Rs;* at stigma; along the cord and outer end of cell *1st* M_2; extreme margin of wing faintly darkened; veins pale brown; *C*, *Sc*, *R* and *Rs* yellow; costa beyond the origin of *Rs* strongly incrassated; costal fringe short; wing-apex obtuse. Venation: Sc_1 ending a short distance beyond the origin of *Rs*, Sc_2 longer than vein M_3 beyond it; basal deflection of Cu_1 beyond the fork of *M*, longer than Cu_2.

Abdomen dark brown, the sternites and hypopygium paler. Valves of the ovipositor straight.

Habitat: Japan (Saikaido). Holotype, ♂, Shuri, Okinawa, Loochoo Islands, altitude 300 feet, March 11, 1923 (S. Sakaguchi). Allotopotype, ♀.

This large and showy *Geranomyia* is named in honor of the collector to whom I am indebted for many Tipulidæ from the Loochoo Islands.

Limonia Meigen.

Limonia divaricata, sp. n.

General coloration reddish brown, the median area of the præscutum broadly dark brown; wings faintly tinged with brown, the stigma oval, *Sc* long, Sc_2 at the tip of Sc_1; veins beyond the cord elongate; male hypopygium with the tip of the ædeagus produced into divaricate blades. *Male.* Length, 5 mm.; wing, 6.5 mm. *Female.* Length, 5 mm.; wing, 6.4 mm.

Rostrum light brown, the palpi darker brown. Antennæ dark brown, the second scapal segment a little paler, the flagellar segments short-oval. Head light gray, more silvery gray anteriorly.

Pronotum dark brown. Mesonotal præscutum reddish brown with a broad dark brown median stripe that becomes obliterated before the suture, the extreme lateral margin behind the pseudosutural foveæ faintly darkened; scutum brownish yellow, each lobe largely covered by a conspicuous dark brown area; scutellum brownish testaceous, faintly pruinose; postnotum pale brown. Pleura obscure yellow, the episternum and mesosternum infuscated. Halteres obscure yellow, the knobs weakly infuscated. Legs with the coxæ and trochanters yellow, the fore coxæ weakly infuscated; femora obscure brownish yellow, slightly darker towards the tip; tibiæ and basitarsi pale brown, the terminal tarsal segments darker. Wings faintly tinged with brown, the stigma oval, slightly darker brown; veins dark brown. Venation: *Sc* long, Sc_1 ending beyond the fork of *Rs*, Sc_2 at the extreme tip of Sc_1 and longer than it; *Rs* shorter than cell *1st* M_2, arcuated; veins beyond the cord elongate, *Libnotes*-like; *r* at tip of R_1; inner ends of cells R_3, R_5 and *1st* M_2 in approximate alignment; *m* and outer deflection of M_3 subequal; basal deflection of Cu_1 near midlength of the elongate cell *1st* M_2; vein M_{1+2} beyond *m* one-half longer than cell *1st* M_2.

Abdominal tergites brown, the sternites still darker, the caudal margins of the segments very faintly paler; hypopygium brown. Male hypopygium with the ventral dististyles relatively small, the mesal face produced into a long, curved, chitinized beak that is unarmed; dorsal dististyle sickle-shaped. Gonapophyses with the mesal apical angle produced into a blackened, gently curved lobe. Aedeagus with each outer lateral angle produced into a flattened, divaricate blade, with two small, acute, parallel points between the blades.

Habitat: Japan (Honshiu). Holotype, ♂, Tokyo, June 10, 1923 (R. Takahashi). Allotopotype, ♀. Paratopotype, ♂.

Limonia imbellis, sp. n.

General coloration light yellow, the pronotum and a cephalic triangle on the præscutum dark brown; antennal scape black, the flagellum yellow; legs black, the extreme bases of the femora and tibiæ paler; wings subhyaline, sparsely seamed with darker; abdomen obscure yellow.

Male. Length, 9 mm.; wing, 9 mm. *Female.* Length, 8 mm.; wing, 8.3 mm.

Rostrum brown, the palpi black. Antennæ with the scapal segments black, the flagellum conspicuously yellow throughout its length, the flagellar segments oval. Head dark gray, the vertex at its narrowest point passing into silvery white.

Pronotum yellow, with a conspicuous brown median stripe. Mesonotum yellow, the extreme cephalic margin of the præscutum with a wedge-shaped dark brown mark. Pleura yellow. Halteres obscure yellow, the apices of the knobs passing into brown. Legs with the coxæ and trochanters yellowish testaceous; femora black, only the narrow bases obscure brownish yellow; remainder of the legs black, the bases of the tibiæ a little paler. Wings subhyaline, the base and costal region yellowish, cells *C* and *Sc* passing into brown before their tips; cell Sc_1 entirely infuscated; stigma small, circular in outline, dark brown; indistinct brown seams at origin of *Rs*, along cord and outer end of cell *1st* M_2, along vein *Cu* and as a narrow margin around the wing; veins brownish black, those in the pale areas yellow. Venation: *Sc* long, Sc_1 extending to opposite one-fourth the basal section of R_{2+3}, Sc_2 some distance from the tip of Sc_1, a little beyond midlength of the distance between the origin of *Rs* and the tip of Sc_1; *Rs* long, gently arcuated; cell *1st* M_2 shorter than M_3 but longer than Cu_1 beyond it; basal deflection of Cu_1 shortly beyond the fork of *M*.

Abdomen obscure yellow, including the male hypopygium, the latter with fleshy ventral dististyles. Ovipositor with the tergal valves slender, gently upcurved.

Habitat: Japan (Taiwan). Holotype, ♂, Urai, altitude about 1,500 feet, April 20, 1922 (K. Takeuchi). Allotopotype, ♀.

Helius St. Fargeau.

Helius subfasciatus, sp. n.

General coloration dark brown, pruinose; rostrum a little longer than the remainder of the head; femora and tibiæ brownish yellow; wings tinged with yellow, with seams of brown along *Cu* and the anterior cord.

Female. Length about 8 mm.; wing, 8.8–9.2 mm.

Rostrum relatively long and slender, about one-third longer than the head, dark brown, including the palpi. Antennæ with the scape black, the flagellum dark brown; flagellar segments cylindrical, passing into oval. Head dark brown, sparsely pruinose.

Pronotum brown, the scutellum obscure yellowish brown. Mesonotum dark brown, gray pruinose, with a median brown vitta, the humeral regions and lateral ends of the suture a little paler; remainder of mesonotum dark brown, sparsely pruinose. Pleura dark brownish black, sparsely pruinose. Halteres obscure brownish yellow. Legs with the coxæ brown, the fore and middle coxæ darker; femora obscure

brownish yellow, the tips only indistinctly darker; tibiæ and tarsi obscure yellow, the terminal segments of the latter passing into brown. Wings tinged with yellow, the base and costal region more saturated; stigma oval, brown; a narrow brown seam along the anterior cord to the fork of *M* and a conspicuous seam along vein *Cu*, chiefly in cell *M;* posterior cord and outer end of cell *1st* M_2 less distinctly seamed; veins brown, the base and costal region more yellowish. Venation: Sc_1 ending opposite the fork of *Rs*, Sc_2 at its tip; deflection of R_{4+5} short, less than *r-m;* basal deflection of Cu_1 more than one-half its length beyond the fork of *M*.

Abdomen dark brown, the long, straight valves of the ovipositor horn-colored, the sternal valves blackened at base.

Habitat: Japan (Taiwan). Holotype, ♀, Musha, altitude about 3500 feet, May 19, 1922 (K. Takeuchi). Paratopotypes, 2 ♀ ♀.

Antocha Osten Sacken.

Antocha (Antocha) **dentifera,** sp. n.

General coloration light gray, the mesonotal præscutum with three rather indistinct brown stripes; wings tinged with gray; vein *Sc* short, the basal deflection of Cu_1 immediately before the fork of *M;* outer dististyle of male hypopygium with an acute chitinized spine on the lateral face immediately before midlength.

Male. Length, 5 mm.; wing, 6.5 mm.

Rostrum grayish brown; palpi dark brown. Antennæ light brown. Head brownish gray, clearer gray along the orbits.

Mesonotal præscutum pale obscure gray with three rather indistinct brown stripes; remainder of mesonotum light gray. Pleura gray. Halteres pale, the knobs brown. Legs long and slender, covered with appressed setæ; coxæ pale, very sparsely pruinose; trochanters pale yellow; remainder of the legs dark brown. Wings tinged with gray, the base a little more whitened; veins pale brown, delicate; stigma pale brown. Venation: *Sc* short, as in *A. brevinervis* Alexander; basal deflection of Cu_1 immediately before the fork of *M*.

Abdomen pale brown, the basal sternites a little paler. Male hypopygium with the basistyles moderately stout, their base on the mesal face setiferous but not produced into a tubercle; outer dististyle with a conspicuous lateral tooth or spine on the outer edge immediately before midlength; apex of outer dististyle obliquely truncated to weakly notched; inner dististyle shorter and stouter than in *A. brevinervis*. Gonapophyses longer and more slender, gently sinuous, their tips feebly divergent.

Habitat: Japan (Honshiu). Holotype, ♂, Mt. Takao, Musashi-no-kuni, altitude 1,000–2,000 feet, May 7, 1922 (T. Esaki). Paratopotype, ♂, April 13, 1923 (T. Esaki).

Orimarga Osten Sacken.

Orimarga formosicola, sp. n.

General coloration light gray; wings tinged with pale brown; *r* about its length from the tip of R_1, the latter extending to opposite midlength of R_{2+3}; basal section of R_{2+3} longer than the basal deflection of R_{4+5}; R_{2+3} with about 28 macrotrichiæ.

Female. Length about 6 mm.; wing, 5.4 mm.

Rostrum and palpi dark brown. Antennæ dark brown throughout, the flagellar segments oval. Head light gray.

Thorax elongate, as in the genus, light gray, the median area of the præscutum and the scutal lobes darker gray. Pleura with the dorsal sclerites brownish gray, the central sclerites paler brown. Halteres obscure yellow, the knobs scarcely darkened. Legs pale brown, the terminal tarsal segments a little darker. Wings with a pale brown tinge, the veins darker brown. Venation: *Sc* moderately elongate, Sc_1 ending near midlength of *Rs*, Sc_2 at its extreme tip; *Rs* strongly angulated at origin; *r* about its own length beyond the tip of R_1, the terminal section of the latter with three macrotrichiæ; R_1 extending to opposite midlength of R_{2+3}; basal section of R_{2+3} from one-third to one-half longer than the basal deflection of R_{4+5}; R_{2+3} with about 28 macrotrichiæ; basal deflection of Cu_1 about opposite one-third the length of *Rs*.

Abdomen elongate, brown, the valves of the ovipositor slender and elongate.

Habitat: Japan (Taiwan). Holotype, ♀, Kanshirei, altitude about 1,000 feet, September 10, 1921 (T. Esaki).

Orimarga taiwanensis, sp. n.

Female. Length about 4.8 mm.; wing, 4.5 mm.

Generally similar to *O. formosicola* sp. n., differing as follows:

Mesonotum, legs and wings darker. Venation very distinct: *Sc* long, ending beyond midlength of *Rs*, Sc_2 scarcely indicated; *Rs* long, arcuated at origin; basal section of R_{2+3} very short, only one-half the basal deflection of R_{4+5} and not much longer than *r* which is placed a little more than its length from the tip of R_1; R_1 ending at about one-fifth the length of R_{2+3}, the latter with about 18 macrotrichiæ; basal deflection of R_{4+5} strongly arcuated at origin; basal deflection of Cu_1 near one-third the length of *Rs*. In the left wing of the type, the extreme base of M_3 is atrophied, leaving the tip suspended as in certain Blepharoceridæ. Abdomen shorter, the valves of the ovipositor short and stout.

Habitat: Japan (Taiwan). Holotype, ♀, Urai, altitude about 1,500 feet, April 20, 1922 (K. Takeuchi).

Ormosia Rondani.

Ormosia arisanensis, sp. n.

General coloration dark brown; antennal flagellum bicolorous; femora yellow, ringed with brown; wings pale brown, variegated with darker brown and hyaline.

Male. Length 4 mm.; wing 6.1 mm.

Rostrum and palpi dark brown. Antennæ of moderate length, the scapal segments dark, the flagellar segments bicolorous, dark brown, with the extreme apex of each segment yellow; flagellar segments cylindrical to elongate-oval. Head dark gray.

Mesonotum gray with three brown stripes; scutal lobes gray with brown centers; scutellum and postnotum dark. Pleura dark gray. Halteres pale yellow. Legs with the coxæ gray; trochanters obscure yellow; femora yellow, each with a brown postbasal and a nearly terminal ring, the broad yellow annulus thus enclosed occupying nearly one-half the segment; on the posterior femora the basal dark ring is indistinct; tibiæ and tarsi obscure yellow, the terminal segments of the latter weakly infuscated. Wings with a pale brown tinge, sparsely variegated with narrow brown seams along the veins and extensive, nearly hyaline areas in certain of the cells; the seams include vein Sc_2, the cord, *r* and the fork of M_{1+2}; stigma large, paler brown; the nearly hyaline areas include the outer ends of cells *1st* R_1, *R*, *M*, and the bases of cells *1st* M_2, *2nd* M_2 and Cu_1; a conspicuous droplet beyond the stigma in cell *2nd* R_1; indistinct brown dots at the tips of the veins where these attain the margin; veins pale yellowish brown, darker in the infuscated areas. Venation: Sc_1 extending to shortly beyond *r*, Sc_2 opposite mid-length of the straight *Rs; r* connecting R_{2+3} some distance before the fork; fork of M_{1+2} symmetrical; vein 2nd A ending opposite one-third the length of *Rs*.

Abdomen dark brown, including the hypopygium, which is rather conspicuously clothed with yellow setæ.

Habitat: Japan (Taiwan). Holotype, ♂, Arisan, altitude about 7,500 feet, May 9, 1922 (K. Takeuchi).

O. arisanensis is closely allied to the smaller *O. pulchra* (Brunetti) of India, differing in the details of coloration and venation. It is very different from the only other described indigenous *Ormosia*, *O. formosana* Edwards.

Ormosia aculeata, sp. n.

General coloration gray, the praescutum with four narrow brown stripes; legs black, the femoral bases conspicuously obscure yellow; wings whitish subhyaline, the stigma and seams along the veins brown; cell *1st* M_2 open by the atrophy of the outer deflection of M_3; anal veins convergent; male hypopygium with each basistyle terminating in a long, acute spine.

Male. Length 4.8 mm.; wing 6.2–6.4 mm. *Female.* Length 6.8 mm.; wing 7.5 mm.

Rostrum and palpi black. Antennæ short, the scape brown, the flagellum black; flagellar segments oval, provided with a dense white pubescence. Head brownish gray.

Pronotum brownish gray. Mesonotum light gray, the praescutum with four light brown stripes, the tuberculate pits jet-black, lying between the intermediate stripes; scutal lobes with faintly darkened centers. Pleura light gray. Halteres light yellow. Legs with the coxæ light gray; trochanters obscure brownish yellow; femora black, the bases broadly obscure yellow, narrowest on the fore legs, broadest on the posterior femora where only the distal fourth is blackened; tibiæ and tarsi black. Wings whitish subhyaline, cells *C* and *Sc* faintly infumed; stigma elongate, dark brown; certain of the longitudinal veins, the tip of R_2 and the cord seamed with brown, most conspicuous along *Cu* and the basal deflection of Cu_1; wing-tip and marginal spots at the veins restrictedly brown. Venation: Sc_1 ending just beyond *r*, Sc_2 shortly beyond mid-length of *Rs; r* on R_2 immediately beyond its origin; veins R_2 and R_3 deflected strongly cephalad at tips; cell *1st* M_2 open by the atrophy of the outer deflection of M_3; *m* transverse and spurred at its union with the distal section of M_3; basal deflection of Cu_1 shortly before the fork of *M;* vein *2nd A* strongly bent, the anal veins convergent.

Abdomen dark gray with light yellow setæ. Male hypopygium with the true ninth tergite ligulate; basistyles stout, the tips narrowed and produced into an acute spine; dististyles on mesal face of basistyle, the larger foot-shaped, the toe directed mesad, near midlength of this appendage is borne a conspicuous black spine that bears numerous short branches; this style is connected basally with clear membrane with the inner dististyle which is more slender, strongly curved, terminating in an acute spine directed caudad. Gonapophyses blackened, especially apically, with small lateral teeth beyond midlength. Aedeagus strongly curved at apex. Ovipositor with the elongate valves horn-colored.

Habitat: Japan (Honshiu). Holotype, ♂, Mt. Takao, Musashi-no-kuni, altitude 1,000–2,000 feet, April 13, 1923 (T. Esaki). Allotopotype, ♀. Paratopotype, ♂.

Erioptera Meigen.

Erioptera (Bæoura) **aliena,** sp. n.

General coloration dark brown, gray pruinose, the scutellum and ovipositor obscure orange; wings subhyaline, the stigma faintly indicated; *Sc* long, R_{2+3} short, cell *1st* M_2 open by the atrophy of *m;* anal veins strongly divergent.

Female. Length about 4.4 mm.; wing 5.5 mm.

Rostrum reddish brown, the palpi brownish black. Antennæ dark brown, the scapal segments tumid. Head black, pruinose.

Pronotum black, the scutellum obscure yellow. Mesonotum black, gray pruinose, the restricted humeral region of the praescutum, a small outer posterior corner of each scutal lobe and the scutellum obscure orange. Pleura gray pruinose, the dorso-pleural membrane obscure buffy. Halteres infuscated, the base of the stem a trifle paler. Legs with the coxæ black, pruinose; trochanters pale brown; remainder of the legs brown, becoming darker towards the tip of the organ. Wings subhyaline, the stigma faintly indicated as a cloud near *r;* veins dark brown. Venation: *Sc* long, Sc_1 ending opposite the fork of R_{2+3}; *Rs* long, straight; R_{2+3} about equal to the arcuated basal section of R_2; cell *1st* M_2 open by the atrophy of *m;* basal deflection of Cu_1 about half its length beyond the fork of *M;* anal veins strongly divergent.

Abdomen dark brownish black, pruinose, the short, fleshy valves of the ovipositor obscure orange.

Habitat: Japan (Taiwan). Holotype, ♀, Urai, altitude about 1,500 feet, April 20, 1922 (K. Takeuchi).

There is no doubt but that this interesting fly is very closely allied to a group of South African Eriopteræ of which *E. nigrolatera* Alexander, may be taken as typical. The short, fleshy valves of the ovipositor are very different from the condition found in normal *Erioptera* and suggest the condition found in the Tanyderidæ, the Cylindrotominæ and other groups. This group of *Erioptera* should have subgeneric ranking and the name *Bœoura* is proposed, with *nigrolatera* as type of the subgenus. The characters of the group are much as in *Erioptera* with the exception of the peculiar ovipositor.

Eripotera (Erioptera) **subsessilis,** sp. n.

General coloration pale brownish ochreous, unmarked; legs brownish yellow; wings subhyaline, the pale brown veins with conspicuous brown macrotrichiæ; cell R_2 subsessile, rectangular at base, at the angle with a long spur that is directed basad; anal veins convergent.

Male. Length about 2.8 mm.; wing, 3.3 mm.

Rostrum and palpi dark brown. Antennæ short, the scapal segments brownish black, the flagellum brownish testaceous, the oval flagellar segments with long verticils. Head infuscated, paler behind.

Mesonotum pale brownish ochreous, without distinct markings. Pleura more testaceous. Halteres pale, the knobs darkened. Legs brownish yellow, the terminal tarsal segments a little darkened. Wings subhyaline, the veins pale brown with long, conspicuous brown macrotrichiæ. Venation: Cell R_2 almost sessile, the basal section perpendicular or nearly so and then bent at a right angle, here sending a long spur basad; the elements of the cord in approximate alignment; petiole of cell M_3 at least two-thirds the cell; anal veins convergent.

Abdomen pale brown. Male hypopygium with the basistyles produced apically into a stout obtuse lobe and a more slender, digitiform lobe, both clothed with long setæ; the dististyles are complex in structure, both appearing as flattened blades; one a flattened triangular blade, the margin heavily blackened, the outer angle produced into a slightly curved slender arm that is again blackened at tip; the second style, which may be connected basally with the one already described, appears as a smaller complex flattened blade, the angles blackened. The gonapophyses are rather remarkable in appearance, each appearing as a stout, curved, blackened hook, on the basal half bearing a high crest whose margin is distinctly serrulate, the apex of the hook a powerful, feebly curved spine; at the base, this appendage bears a longer and more slender, gently curved arm that is a little blackened at the apex. Aedeagus small, fleshy.

Habitat: Japan (Taiwan). Holotype, ♂, Kanshirei, altitude about 1,000 feet, September 10, 1921 (T. Esaki).

Gnophomyia Osten Sacken.

Gnophomyia nycteris, sp. n.

General coloration black; antennæ moderately elongate; knobs of halteres yellow; femora yellow, the tips broadly dark brown; wings faintly tinged with brown, the extreme base yellowish; veins beyond cell *1st* M_2 elongate.

Female. Length about 5 mm.; wing, 6.3 mm.

Rostrum and palpi black. Antennæ black, rather elongate, if bent backward extending to a short distance beyond the base of the abdomen. Head black.

Mesonotum and pleura black, the dorso-pleural membrane a little paler. Halteres pale, the knobs obscure yellow. Legs with the coxæ dark brown; trochanters obscure yellow; femora yellow, the tips broadly and conspicuously dark brown, more extensive on the fore femora; tibiæ light brown, the tips narrowly darker; tarsi dark brown. Wings faintly tinged with brown, the extreme base yellowish; veins dark brown. Venation: Sc_1 ending opposite the fork of R_{2+3}, Sc_2 about opposite the fork of *Rs*, the latter nearly straight and about in alignment with R_{4+5} whose deflection is lacking or approximately so; *r-m* long; cell *1st* M_2 very narrow at its proximal end; M_{1+2} beyond cell *1st* M_2 more than twice this cell; basal deflection of Cu_1 at about two-fifths the length of the cell.

Abdomen brownish black, the valves of the ovipositor short, horn-colored.

Habitat: Japan (Honshiu). Holotype, ♀, Mt. Minomo, Settsu-no-kuni, October 11, 1922 (T. Esaki).

Gnophomyia confluenta, sp. n.

General coloration black, sparsely pruinose; legs and halteres black; wings with a faint brownish tinge; Sc_1 long, *r* lacking, *cell 1st* M_2 open by the atrophy of the outer deflection of M_3.

Male. Length about 5.5 mm.; wing, 7–7.2 mm.

Rostrum and palpi black. Antennæ moderately elongate, if bent backward not reaching quite to the base of the halteres, black throughout; flagellar segments elongate-oval. Head dull black, sparsely pruinose.

Pronotum dark brown, the lateral lobes of the scutellum obscure reddish. Mesonotum and pleura black, gray pruinose. Halteres black, only the base of the stem indistinctly pale. Legs black, moderately hairy. Wings with a faint brownish tinge, the elongate, ill-delimited stigma darker brown; veins dark brown. Venation: Sc_1 ending just before the fork of *Rs*, Sc_2 removed to some distance from the tip, lying just beyond mid-distance between the origin of *Rs* and the tip of Sc_1; *r* lacking; deflection of R_{4+5} distinct, more than one-half *r-m;* cell *2nd* M_2 very deep, approximately four times its petiole; cell *1st* M_2 open by the atrophy of the outer deflection of M_3; basal deflection of Cu_1 at the fork of *M*.

Abdomen, including the hypopygium, black.

The paratype is generally similar to the type but the legs are somewhat paler and the antennæ appear somewhat shorter.

Habitat: Japan (Taiwan). Holotype, ♂, Horisha, altitude about 1,500 feet, May 5, 1922 (K. Takeuchi). Paratype, ♂, Urai, altitude about 1,500 feet, April 20, 1922 (K. Takeuchi).

Rhabdomastix Skuse.

Rhabdomastix (Sacandaga) **japonica,** sp. n.

Head obscure yellow, dark brown medially; general coloration obscure yellow, the præscutum with three indistinct darker stripes; pleura indistinctly striped longitudinally with darker; halteres light yellow; wings faintly tinged with yellowish brown.

Female. Length, 6.5 mm.; wing, 6.8 mm.

Rostrum and palpi dark brown. Antennæ brownish black throughout. Head obscure yellow, the center of the vertex and the occiput conspicuously dark brown.

Mesonotal præscutum obscure yellow with three indistinct grayish brown stripes; scutal lobes gray; scutellum pale; postnotum with the mediotergite pale brown, with a large, yellow, subbasal area at the sides. Pleura obscure yellow, indistinctly striped longitudinally with dark brown, the dorsal stripe ill-defined and broken, the ventral or sternal stripe very distinct. Halteres very light yellow throughout. Legs with the coxæ and trochanters obscure yellowish brown; remainder of the legs brown, the terminal tarsal segments darker brown. Wings with a faint yellowish brown tinge, the base and costal region clearer

yellow; stigma very ill-defined, pale brown; veins brown. Venation: *Sc* long, Sc_1 ending beyond three-fourths the length of *Rs*, Sc_2 removed from the tip of Sc_1, the latter alone about one and one-half times the length of *r-m*; R_2 equal to or less than its own length from the tip of R_1 at the wing-margin; *m* lying more distad than the outer deflection of M_3. Macrotrichiæ almost as in *R.* (*S.*) *schistacea* (Schummel).

Abdomen brown, the segments narrowly and indistinctly obscure yellow at their caudal margins. Ovipositor with the valves dark horn color.

Habitat: Japan (Honshiu). Holotype, ♀, Tokyo, May 24, 1922 (T. Esaki).

Pseudolimnophila Alexander.

Pseudolimnophila marcida, sp. n.

General coloration brown, the præscutum brighter anteriorly and laterally; antennæ brown throughout; wings strongly tinged with brown; basal deflection of Cu_1 beyond midlength of cell *1st* M_2.

Male. Length, 6.3 mm.; wing, 8.1 mm.

Rostrum and palpi brown. Antennæ brown throughout, the verticils relatively short. Head brown, the vertex broad.

Mesonotum brown, the præscutum rich reddish brown in front and laterally. Pleura light brown with a longitudinal darker brown stripe extending from the cervical sclerites to the halteres. Halteres dark brown. Legs yellowish brown. Wings with a strong brownish tinge, the stigma scarcely darker; veins dark brown. Venation: Sc_1 ending opposite the fork of *Rs*, Sc_2 at its tip; *Rs* strongly arcuated at origin; *r* less than its length from the tip of R_1 and before midlength of R_2; petiole of cell M_1 a trifle shorter than R_{2+3}; *m* shorter than the outer deflection of M_3; basal deflection of Cu_1 at three-fifths the length of cell *1st* M_2; anterior arculus broken.

Abdominal tergites brown, the terminal segments passing into black, the basal sternites obscure yellow, ringed basally with brown.

Habitat: Japan (Taiwan). Holotype, ♂, Musha, altitude about 3,500 feet, May 19, 1922 (K. Takeuchi).

Tricyphona Zetterstedt.

Tricyphona optabilis, sp. n.

General coloration gray, the mesonotal praescutum with three velvety black stripes; legs black, the femoral bases broadly yellow; wings with cell R_3 sessile, cell R_4 short-petiolate, cell *1st* M_2 closed, cell M_1 sessile; gonapophyses of male hypopygium bifid at apices.

Male. Length about 8 mm.; wing 9.6 mm.

Rostrum and palpi black. Antennæ black, the flagellar segments short-cylindrical; antennæ of moderate length. Head dark gray.

Pronotum dark gray. Mesonotal praescutum gray with three very conspicuous velvety black stripes, the median stripe distinctly bifid caudally, not attaining the suture; scutum gray, each lobe with two triangular velvety black spots, the more anterior being a continuation of the lateral praescutal stripes; scutellum and postnotum velvety black, possibly pruinose in fresh specimens. Pleura dark gray. Halteres with the base yellow, the remainder broken. Legs with the coxæ dark gray, all but the posterior pair passing into yellow at tips; trochanters yellow; femora brownish black, the bases broadly and conspicuously yellow, narrowest on the fore legs, broadest on the posterior legs where approximately the basal half is included; remainder of the legs black. Wings with a faint brown tinge, the base yellowish; stigma pale brown; inconspicuous pale brown seams at origin of *Rs*, along the cord and behind vein *Cu;* veins dark brown, *Sc* pale brown, the prearcular veins yellow. Venation: Sc_2 a short distance basad of the origin of *Rs*, this distance about equal to R_3 alone; *Rs* square and long-spurred at origin; cell R_3 sessile, the outer deflection of R_2 subperpendicular and less than its length from the tip of the fused R_1 plus R_2; petiole of cell R_4 short, a little less than *r-m*, the latter connecting with R_{4+5} just beyond its origin; cell *1st* M_2 closed, *m* connecting M_3 with the fork of M_{1+2}, cell M_1 thus being sessile; basal deflection of Cu_1 about one-third its length beyond the fork of *M;* fusion of M_3 and Cu_1 a little less than *r-m*.

Abdomen dark gray, the sternites a little paler basally. Male hypopygium with the basal dististyle slender, gently arcuate, not noticeably dilated distally; numerous powerful setæ at apex and extending basad to about midlength of the appendage, basad of which point the setæ are very delicate and few in number; at its base, this appendage is united with a pale lobe of nearly equal length, this provided with rather numerous long setæ. Apex of basistyle blackened and densely set with microscopic spinulæ. Gonapophyses strongly arcuated, with a basal tubercle on the mesal edge, the apex of each apophyse split into two teeth.

Habitat: Japan (Honshiu). Holotype, ♂, Otaki, Chichibu, Saitama-Ken, April 23, 1922 (J. Machida).

Tricyphona arisana, sp. n.

General coloration dark gray, the praescutum with three brown stripes; coxæ and pleura dark gray; wings nearly hyaline, the stigma scarcely indicated; cell *1st* M_2 closed; abdomen dark brownish gray throughout.

Female. Length about 5.5 mm.; wing 8.5 mm.

Rostrum, antennal scape and palpi black. Head dark gray. Mesonotal praescutum light gray with three brown stripes, the median stripe very broad, darker than the lateral stripes, with a faint indication of a capillary median vitta; lateral stripes relatively short; scutum gray, the lobes brown; scutellum and postnotum dark brown with a dark gray pruinosity. Pleura gray. Halteres pale, the knobs scarcely

darker. Legs with the coxæ dark brown, gray pruinose; trochanters brown; femora brownish yellow, passing into brown at the tips; tibiæ and basal segments of the tarsi pale brown, the tips of the segments still darker; terminal tarsal segments uniformly dark. Wings nearly hyaline, the stigma a very little darker; veins brown. Venation: Sc_2 far before the origin of *Rs;* outer deflection of R_2 more than twice its length from the fused tip of R_1 and R_2; *r-m* near one-fourth the length of the deflection of R_{4+5}.

Abdomen dark brown throughout, gray pruinose. The long, powerful valves of the ovipositor yellowish horn-color.

Habitat: Japan (Taiwan). Holotype, ♀, Arisan, altitude about 7,500 feet, May 9, 1922 (K. Takeuchi).

Tricyphona arisana is most closely related to the Indian *T. glabripennis* (Brunetti).

Rhaphidolabina Alexander.

Rhaphidolabina dicranotoides, sp. n.

General coloration pale yellowish white, the head light gray pruinose; antennæ pale, the scape darker; wings with a faint yellowish tinge, the veins sparsely variegated with dark brown; wing-base conspicuously white; *r* and *m* present.

Female. Length 5.6–6 mm.; wing 5.8–7 mm.

Rostrum gray pruinose; palpi yellow. Antennæ with the scape pale brown, the flagellum pale yellow. Head light gray pruinose.

Thorax pale yellowish white, the pronotum and mesonotum dusted with white. Halteres pale yellowish white. Legs white, the femoral tips, the tibiæ and tarsi very faintly darker. Wings with a faint yellowish tinge, the veins sparsely variegated with brown to produce a guttulate appearance; the principal dots occur on vein *R* at base, at Sc_2 and adjoining parts of *Sc* and *R;* origin of *Rs* and adjoining parts of *R;* along the cord and outer end of cell *1st* M_2; at R_2 and adjoining part of veins which it connects; tips of the longitudinal veins at the wing-margin; fork of M_{1+2} and less distinct dots at intervals along the longitudinal veins beyond the cord; veins yellow except in these infuscated areas; prearcular cells conspicuously white. Venation: Sc_2 far before the origin of *Rs,* the distance about equal to the last section of R_1; *Rs* long, strongly arcuated to angulated and spurred at origin; *r* present, in the exact position where found in *Dicranota;* basal deflection of R_5 very short; *m* present, closing cell *1st* M_2; basal deflection of Cu_1 a short distance beyond the fork of *M*.

Abdomen pale yellowish brown, clearer basally. Ovipositor with the valves brown, gently upcurved.

Habitat: Japan (Honshiu). Holotype, ♀, Mt. Takao, Musashi-no-kuni, altitude 1,000–2,000 feet, May 7, 1922 (T. Esaki). Paratopotype, ♀.

Rhaphidolabina dicranotoides has a venation that is almost exactly like a *Dicranota* but a comparison with related species, especially *R. gibbera* Alexander (Japan) shows that it is to be referred to *Rhaphidolabina*.

Tipula Linnæus.

Tipula foliacea, sp. n.

Related to *T. himalayensis* Brunetti; general coloration brownish yellow, the praescutum with three brown stripes, the median one bisected; apex of halteres yellow; femora black with a conspicuous yellow subterminal ring; male hypopygium with each lateral angle of the ninth tergite produced caudad into a long foliaceous blade.

Male. Length about 13.6 mm.; wing 18.3 mm.

Frontal prolongation of the head obscure yellow, the elongate nasus concolorous, the sides and lower surface infuscated; palpi dark brown. Antennæ of moderate length, if bent backward extending about to the wing-root; basal segment fulvous, the second segment yellow; flagellar segments bicolorous, the weak basal enlargement black, the remainder of the segment yellow; terminal flagellar segments passing into uniform brown. Head brownish fulvous, the vertical tubercle more yellowish, with a brown spot at its base at the narrowest point of the vertex.

Mesonotal praescutum brownish yellow, with three brown stripes, the median stripe split by a capillary pale vitta to appear double; scutum grayish brown, each lobe with two confluent brown areas; scutellum and postnotum brownish yellow, indistinctly darker medially. Pleura obscure yellow, sparsely and indistinctly variegated with darker. Halteres yellow, the base of the knob conspicuously dark brown. Legs with the coxæ and trochanters yellow; femora black, the bases yellow, each femur with a broad, conspicuous, subterminal yellow ring that is broader than the black apex; remainder of the legs black; tarsi long and slender. Wings faintly tinged with yellow, the base and cells *C* and *Sc* bright yellow; a heavy brown clouded pattern, as follows: A spot at origin of *Rs*, the stigma and a confluent seam along the anterior cord and a seam along vein *Cu* darker; the remaining paler clouds are much as in *T. arisanensis* Edwards or *T. biserra* Edwards. Venation: Petiole of cell M_1 a little shorter than *m;* fusion of M_3 and Cu_1 short.

Abdomen brownish yellow, the terminal segments passing into black. Hypopygium black, the foliaceous apices of the lateral lobes of the ninth tergite yellowish. Male hypopygium with the ninth tergite of quite unusual shape, the lateral angles produced caudad and slightly ventrad into long, foliaceous blades that are obliquely bidentate at their tips, the median caudal area of the tergite squarely truncated, with a tiny V-shaped median notch subtended on either side by a small reddish projection. Ninth sternite and basistyle simple. Eighth sternite unarmed.

Habitat: Japan (Taiwan). Holotype, ♂, Arisan, altitude 7500 feet, May 9, 1922, (K. Takeuchi).

Nephrotoma Meigen.

Nephrotoma takeuchii, sp. n.

General coloration velvety-black, the praescutum with three straight, shiny black stripes; abdominal segments two to four orange; wings strongly tinged with brown.

Male. Length 12 mm.; wing 10.5 mm. *Female.* Length 13 mm.; wing 11 mm.

Frontal prolongation of the head and the palpi black. Antennæ black throughout, of moderate length, the flagellar segments feebly incised; antennæ of female shorter. Head black, with a broad orange triangle on vertex, the anterior end occupying the vertical tubercle; a large black orbital spot behind each antennal fossa; occipital region black, the brand shiny.

Pronotum, mesonotum and pleura black, the praescutum velvety black with three shiny black stripes, the lateral stripes straight; scutal lobes and scutellum shiny. Halteres dark brown. Legs with the coxæ and trochanters black; femora black, the central portion of the posterior femora fading into brown in the female, brownish yellow in the male; remainder of the legs black. Wings strongly tinged with brown, the cells beyond the cord and the Anal cells a little paler; costal region more saturated; stigma dark brown; veins dark brown. Venation: *Rs* one-half longer than the basal deflection of R_{4+5}; cell M_1 barely sessile; *m-cu* preserved, at the fork of *M*.

Abdomen with segments one, six to nine, and the extreme caudal margin of the fifth tergite in the male black, the intermediate segments conspicuously orange.

Habitat: Japan (Taiwan). Holotype, ♂, Urai, altitude about 1,500 feet, April 20, 1922 (K. Takeuchi). Allotopotype, ♀.

This striking *Nephrotoma* is named in honor of the collector, to whom I am very greatly indebted for many Tipulidæ from Honshiu and Taiwan.

DISTRIBUTION OF THE MALPIGHIAN VESSELS IN THE WALL OF THE RECTUM OF LEPIDOPTEROUS LARVÆ

NAOTO ISHIMORI,
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The distribution of the Malpighian vessels in the wall of the rectum of lepidopterous larvæ has been studied by S. Metalnikov (1908) in the larva of Galleria mellonella, the same subject on the silkworm (*Bombyx mori*) was studied by E. Ikeda (1913), by A. Foa (1920) and N. Ishimori (1916). But in these studies, the manner of their distribution was not made clear, so I tried to renew my investigations on the silkworm and at the same time I extended my observations in various other lepidopterous larvæ, the result of which is given here.

The silkworm material is that reared in our faculty, while that of the other lepidopterous larvæ was either reared from eggs or collected by myself in the field. They were fixed by sublimate alcohol, hardened and colored as usual.

It is not necessary to say that, in all the lepidopterous larvæ the Malpighian vessels are six in number, or in three pairs, and are long and slender. One half of the pairs, or three, are given out on each ventro-lateral side of the anterior part of the hind-gut, they run up anteriorly on the surface of the mid-gut as far as the anterior one-third of its length, then turn back posteriorly till they reach the rectum where they enter its wall.

THE STRUCTURE OF THE RECTUM.

The wall of the rectum of lepidopterous larvæ is generally composed of the following layers:

1. Chitinous intima.
2. Epithelium (with basement membrane).
3. Double thin membrane.
4. Simple thin membrane.
5. Muscular layer.

If we examine a cross-section of the rectum of any lepidopterous larva, we can detect two sets of Malpighian vessels arranged in circles, an inner and an outer. Those of the inner circle (Pl. XIV, Fig. 1, i, m) lie in a space between the

epithelium (ep) and the double thin membrane (md), while those of the outer circle (om) in a space between the simple (ms) and the double membrane (md).

For the sake of convenience, I will call the vessels of the inner circle "the Malpighian vessels of the inner row" and those of the outer "the Malpighian vessels of the outer row."

The walls of the vessels of the inner row are thicker than those of the outer row, whose walls are thin and so delicate that they are sometimes hard to trace.

The double thin membrane (Pl. XIV, Fig. 1, md) is composed of two layers of flat cells, having indistinct or obscure outlines and with their nuclei usually elliptical in shape. (Fig. 2). The simple thin membrane (Fig. 1, ms) is formed of a single layer of flat cells, lying beneath the muscular layer which forms the outer layer of the rectum. The cells of this membrane are quite similar in nature to those of the double thin membrane.

The muscular or the outermost layer of the rectum is of two sorts, a transverse and a longitudinal, the former lies beneath the latter. (Pl. XIV, Fig. 1, tm and lm).

All the Malpighian vessels, passing into the wall of the rectum, proceed into the space lying between the simple- and double thin membrane, where they descend posteriorly in a zig-zag way, then they find their way into the space between the double thin membrane and the epithelium in many convolutions and finally each of them terminates in a blind end.

THE MALPIGHIAN VESSELS IN THE WALL OF THE RECTUM.

To examine the convolutions of the Malpighian vessels within the wall of the rectum, the entire rectum is taken out from the larva and cut longitudinally along one of the lateral lines. After staining, it is spread on a slide with its inner side directed up. The chitinous intima, the epithelium and sometimes the longitudinal muscles are removed by using the points of needles under a dissection microscope till the Malpighian vessels of the inner row come into sight. The Malpighian vessels of the inner row are now to be examined. Then by removing those of the inner row with care, the vessels of the outer row come naturally into view. Since they are very delicate, the operations are rather difficult and several specimens are usually required.

1. *The Malpighian Vessels of the Outer Row.*

As the six Malpighian vessels pass into the wall of the rectum, in the space between the simple- and double thin membrane, each of the vessels soon enlarges and sometimes gives out several broad coecal appendages, but resuming soon its normal size, begins to convolute and descend posteriorly. These coecal appendages of the vessels sometimes fuse with each other, forming a sort of meshwork (Pl. XV, Fig. 21b, 25, 26). These coecal appendages are nothing else than the enlargements of the cells forming the wall of the vessel, because each of them contains a nucleus. (Figs. 22a, 30b). In some species of Saturnia and in some other lepidopterous larvæ, similar features are to be found just before their vessels pass into the wall of the rectum. (Fig. 34). But there are some variations in the shape of these coecal appendages even among the individuals of the same species, and further more in the silkworm these become more complex as the worm grows. (Fig. 22, a, b, c).

The studies of the Malpighian vessels of the outer row of the lepidopterous larvæ teach us that, notwithstanding the different shapes of the coecal appendages in larvæ of different families (Pl. XIV, Fig. 3b, 6b, 9b, 11b, Pl. XV, 23b, 24, 25, 27b, 28b and 30b), there is always a single type of the convolutions in the outer row, which is common to all of the larvæ, as shown in the Text Figure 1.

In the larva of *Apha tichona* Butl., the vessels form a sort of meshwork by ramifications, (Fig. 26), after forming the broad coecal appendages, while in all others they are simple.

2. *The Malpighian Vessels of the Inner Row.*

The Malpighian vessels of the inner row have been already described by S. Metalnikov in the larva of *Galleria mellonella* as "tubes de contourne" and the vessels of the outer row as the Malpighian vessels. His description of the junction of the Malpighian vessels and the "tubes de contourne," as well as the structure of the rectum seems rather imperfect. According to my observation, the structure of the rectum of this larva is quite identical with that of the silkworm or with any other lepidopterous larvæ. E. Ikeda considers that the coecal appendages of the vessels of the outer row are their terminal ends and

his figure of their convolutions seems not quite right. H. Ito (1920) perceives the vessels of the outer row, but says nothing about their convolutions. A. Foa describes the vessels of the outer row as "strato superficiale dei Malpighiani," and those of the inner row as "strato profondo dei Malpighiani," but she says little about their convolutions.

Fig. 1. The diagram of the convolutions of "the Malpighian vessels of the outer row."

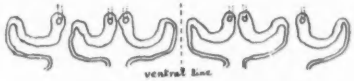


Fig. 2. The type I.

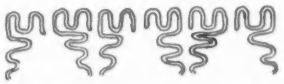


Fig. 3. The type II.

Fig. 4. The type III.

Fig. 5. The type IV.

Fig. 6. The type V.

Fig. 7. The type VI.

TEXT FIGURES 1–7.

The Figs. 2–7 are the diagrams of the types of the convolutions of "the Malpighian vessels of the inner row."

In the larva of *Bombyx mori*, the convolution of the vessels of the inner row are shown in Pl. XV, Fig. 21a, in which we find that each vessel terminates in a blind end. I find six different types of convolution.

Each family has always one and the same type of convolution, with the exception of Nymphalidæ, in which two types

(type IV and V) seem to occur. (Compare those of the Noctuidæ, Pl. XIV, Figs. 15d and 16a).

TYPE I. Each vessel convolutes without forming loops (Text Fig. 2). The species and families belonging to this type are shown below:

SPECIES	FAMILY	NO. OF FIG.
Hyponomeuta enonymella Mats.	Hyponomeutidæ	
Alucita vilis Butl.	Pterophoridæ	
Exartema mori Mats.	Tortricidæ	3a
Cerostoma sasakii Mats.	Pluteridæ	4
Galleria mellonella L.	Pyralidæ	5
Saccada approximas Leech.	Pyralidæ	
Chilo simplex Butl.	Pyralidæ	
Aegeria hector Butl.	Aegeriidæ	6a
Clania sp.?	Psychidæ	7a
Cnidocampa flavescens Wk.	Chochlididæ	8a
Chalcosia remota Wk.	Zygaenidæ	9a
Parnara guttatus Brem.	Hesperiidæ	10
P. pellucida Murray	Hesperiidæ	
Taraka hamada Dr.	Lycaenidæ	11a
Polymantus bacticus L.	Lycaenidæ	
Lithe sicelis Hew.	Satylidæ	31

It is noteworthy that this type includes the microlepterous families and small Rhopalocera. It seems to me that this type is a primitive form.

TYPE II. Each vessel convolutes and forms a single loop, (Text Fig. 3). To this type belong the following species and families:

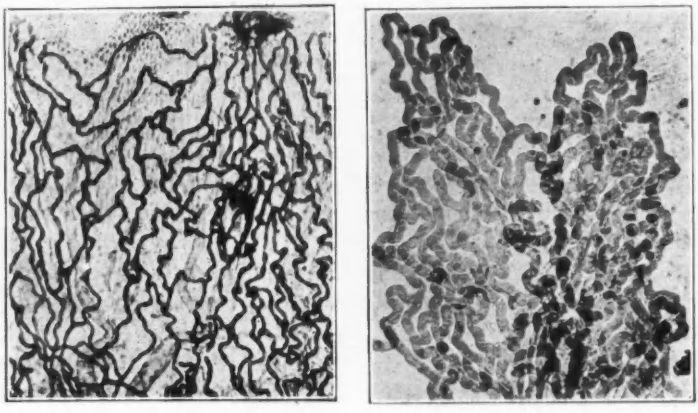
SPECIES	FAMILY	NO. OF FIG.
Hemerophila atrilineata Butl.	Geometridæ	12a
Abraxas sylvata Scop. var. *mirauda* Butl.	Geometridæ	
Lithosia quadra L.	Arctiidæ	
Spiarctia subcarnea Wk.	Arctiidæ	13a
Sp. imparilis Butl.	Arctiidæ	
Earis cupreoviridis Wk.	Arctiidæ (Cymbidæ)	14a
Brathra brassicæ L.	Noctuidæ	15a
Acronicta rumicis Brem.	Noctuidæ	16a
A. major Brem.	Noctuidæ	
Zallissa subflava Butl.	Noctuidæ	
Auzata superba Butl.	Drepanulidæ	
Oreta calida Butl.	Drepanulidæ	23a
Dictioploca japonica Moor.	Saturnidæ	17a
Anthrea pernyi Guer.	Saturnidæ	
Cosmotriche potatoria L.	Lasiocampidæ	18a
Malacosoma neustria L. var. *testacea* Motsch.	Lasiocampidæ	
Lymantria dispar L.	Lymantriidæ	19a
Orgya thyellina Butl.	Lymantriidæ	
Phalera flavescens Brem et Gray	Notodontidæ	20a
Semidonta manleyi Leech.	Notodontidæ	
Bombyx mori L.	Bombycidæ	21a

To this type belongs the majority of families of Macrolepidoptera Heterocera.

TYPE III. Each vessel sends out numerous branches and forms a meshwork, (Text Fig. 4 and 8). The species and families belonging to this type are as follows:

SPECIES	FAMILY	NO. OF FIG.
Apha tichona Butl	Eupterotidæ	Text Fig. 8b
Theretra ordenlandiæ F	Sphingidæ	Text Fig. 8a
Acrotia styx West	Sphingidæ	
Brahmaea japonica Butl	Brahmaeidæ	
Pieris rapæ L	Pieridæ	27a
P. hyale L	Pieridæ	

This type includes three families of Macrolepidoptera Heterocera and the family Pieridæ in Rhopalocera.



a b

FIG. 8. PHOTOGRAPHS OF MALPIGHIAN TUBULES.
a. Tubules of the inner row of *Theretra ordenlandiæ*. b. Tubules of the inner row of *Apha tichona*.

TYPE IV. Each vessel of the ventral pair forms a loop, while those of the other two pairs do not, (Text Fig. 5). Only one species belonging to this type is found:

SPECIES	FAMILY	NO. OF FIG.
Pyramaeis indica Herbst	Nymphalidæ	28a

TYPE V. The vessels of the ventral and dorsal pair are looped, while those of the lateral pair are not, (Text Fig. 6). Only one species belonging to this type is found:

SPECIES	FAMILY	NO. OF FIG.
Diagora japonica Feld	Nymphalidæ	29

TYPE VI. The ventral and the lateral pairs are looped once, those of the dorsal pair make a double loop, (Text Fig. 7). Only the Papilionidæ has this type.

SPECIES	FAMILY	NO. OF FIG.
Papilio xuthus L.	Papilionidæ	30a
Pap. machaon L.	Papilionidæ	
Pap. demetrius C.	Papilionidæ	

From these it will be seen that those families of Type III (Euterotidæ, Sphingidæ, Brahmaeidæ and Pieridæ) are quite different from others in forming a meshwork, while the other families are more or less similar to each other. With only a single exception of Nymphalidæ, the other families of Rhopalocera have each a single type, whereas in Heterocera one and the same type is found common to several families.

The most remarkable case is found in the larvæ of Hepialids, in which the structure of the rectum wall as well as the terminations of the Malpighian vessels differs completely from all the other larvæ of Lepidoptera.

In the larvæ of this family found in our country, *Phassus signiferans* and *Ph. excrescens*, I can observe no entry of the vessels into the wall of the rectum, but they terminate within the body cavity (coelom), joining three vessels of each side at their terminations, (Pl. XV, Fig. 38). The structure of the wall of the rectum is also simple, being destitute of both the simple- and the double membrane which are to be found in the larvæ of the other families.

The classification of Lepidoptera into Jugatæ and Frenatæ is thus justified even from the study of this character.

The Malpighian vessels of the inner row have thick walls, richly provided with tracheæ and contain in their lumen a substance which stains yellow with picric acid, while those of the outer row have thin walls and are entirely destitute of tracheæ. These facts suggest that the two rows of the Malpighian vessels have different functions.

The blind end of the vessel is usually more or less irregular in shape, but shows no different structure from the rest of the vessels of the inner row, (Pl. XV, Fig. 33).

SUMMARY.

1. The Malpighian vessels of the lepidopterous larvæ are arranged in two rows, the inner and the outer, within the wall of the rectum, with an exception of Hepialids.

2. The convolutions of the vessels of the outer row are similar in all lepidopterous larvæ, but the shape of their coecal appendages differ to a certain extent.

3. Six types of the convolutions of the vessels of the inner row are distinguished, each of which is common in one family, except the Nymphalidæ, which has two types.

4. In the Hepialid larvæ, the structure of the rectum wall as well as the arrangement of the Malpighian vessels are entirely different, in which three vessels of each side join at their ends and rest freely in the body cavity without passing into the wall of the rectum.

5. The end of the Malpighian vessel is not different in structure from other parts. Since both the structure and the content of the vessels of the two rows are different, we can consider that their functions are also different.

The writer wishes to thank Prof. C. Sasaki, of Tokyo Imperial University, for his helpful advice and suggestions.

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EXPLANATION OF PLATES.

PLATE XIV.

Fig. 1. Cross section of the rectum of the silkworm *Bombyx mori*.

ch—chitinous intima
e—Malpighian vessel passing into wall of rectum.
ep—epithelium.
im—Malpighian vessels of the inner row.
lm—longitudinal muscle.
md—double thin membrane.
ms—simple thin membrane.
n—nucleus.
om—Malpighian vessels of the outer row.
tm—transverse muscle.
tr—trachea.

Fig. 2. Surface view of double thin membrane, Bombyx mori.

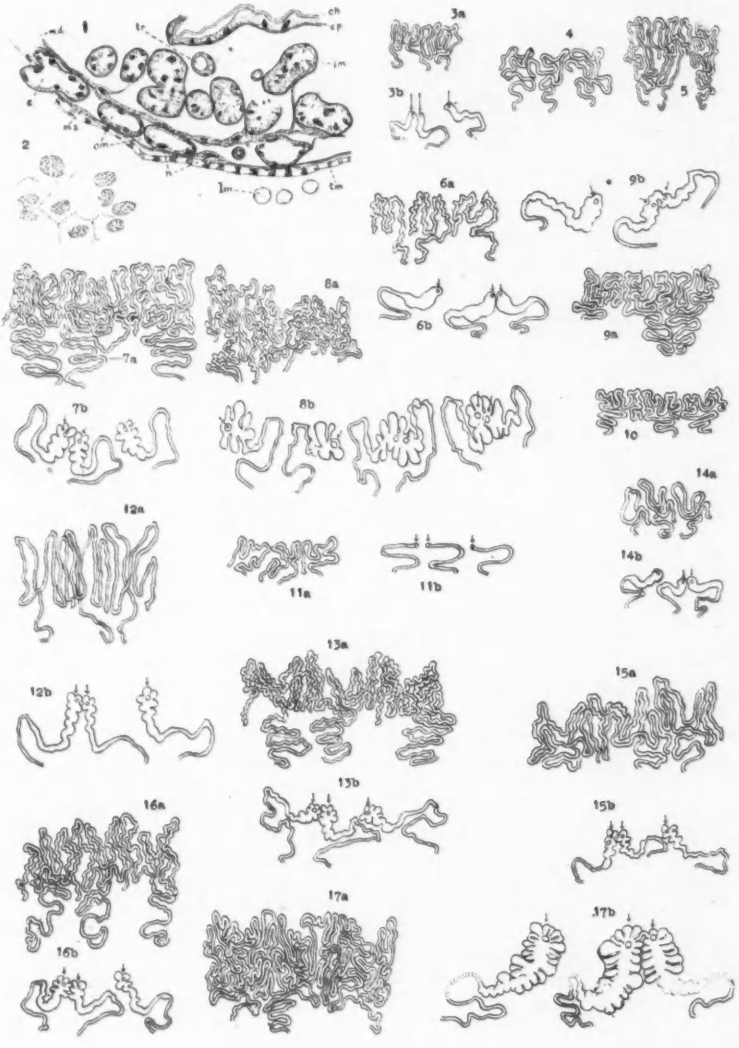
Figs. 3a–31 show the arrangement of the Malpighian vessels in various species of Lepidoptera. In the following explanations, Inner means the inner row, and Outer the outer row. (R) means vessels of the right side, (L) those of the left side. As the six vessels are arranged symmetrically as shown in Fig. 8b, one side is omitted in the other figures. The arrow indicates the entrance of the vessel into the wall of the rectum.

Fig. 3a. Inner (L), *Exartema mori* Mats.
Fig. 3b. Outer (R), *Exartema mori* Mats.
Fig. 4. Inner (R), *Cerostoma sasakii* Mats.
Fig. 5. Inner (R), *Galleria mellonella* L.
Fig. 6a. Inner (R), *Aegeria hector* Butl.
Fig. 6b. Outer (L), *Aegeria hector* Butl.
Fig. 7a. Inner (R), *Clania* sp.?
Fig. 7b. Outer (R), *Clania* sp.?
Fig. 8a. Inner (R), *Cnidocampa flavescens* Wk.
Fig. 8b. Outer (R and L), *Cnidocampa flavescens* Wk.
Fig. 9a. Inner (L), *Chalcosia remota* Wk.
Fig. 9b. Outer (L), *Chalcosia remota* Wk.
Fig. 10. Inner (L), *Parnara gulatus* Brem.
Fig. 11a. Inner (R), *Taraka hamada* Dr.
Fig. 11b. Outer (R), *Taraka hamada* Dr.
Fig. 12a. Inner (L), *Hemerophila atrilineata* Butl.
Fig. 12b. Outer (R), *Hemerophila atrilineata* Butl.
Fig. 13a. Inner (R), *Spiarctia imparilis* Butl.
Fig. 13b. Outer (R), *Spiarctia imparilis* Butl.
Fig. 14a. Inner (L), *Earis cupreoviridis* Wk.
Fig. 14b. Outer (L), *Earis cupreoviridis* Wk.
Fig. 15a. Inner (L), *Brathra brassicæ* L.
Fig. 15b. Outer (R), *Brathra brassicæ* L.
Fig. 16a. Inner (R), *Acronicta rumicis* Schiff.
Fig. 16b. Outer (R), *Acronicta rumicis* Schiff.
Fig. 17a. Inner (R), *Dictioploca japonica* Moor.
Fig. 17b. Outer (L), *Anthraea pernyi* Guer.

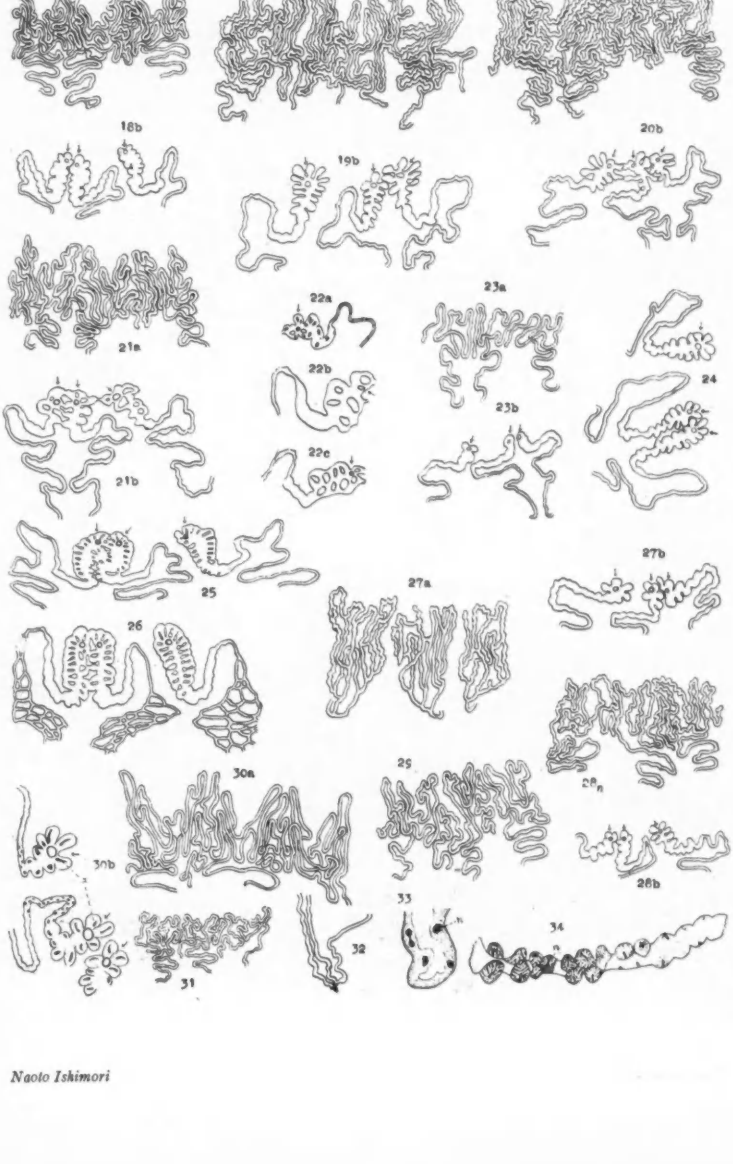
PLATE XV.

Fig. 18a. Inner (R), *Cosmotriche potatoria* L.
Fig. 18b. Outer (R), *Cosmotriche potatoria* L.
Fig. 19a. Inner (L), *Lymantria dispar* L. var. *japonica* Mosch.
Fig. 19b. Outer (L), *Lymantria dispar* L. var. *japonica* Mosch.
Fig. 20a. Inner (L), *Phalera flavescens* Brem.
Fig. 20b. Outer (L), *Phalera flavescens* Brem.
Fig. 21a. Inner (R), *Bombyx mori* L.
Fig. 21b. Outer (R), *Bombyx mori* L.

Fig. 22a. Outer (R), *Bombyx mori* L. at second age.
Fig. 22b. Outer (R), *Bombyx mori* L. at third age.
Fig. 22c. Outer (R), *Bombyx mori* L. at fourth age.
Fig. 23a. Inner (R), *Oreta calida* Butl.
Fig. 23b. Outer (L), *Oreta calida* Butl.
Fig. 24. Outer (L), *Theretra ordenlandiæ* F.
Fig. 25. Outer (R), *Brahmaea japonica* Butl.
Fig. 26. Outer (R), *Apha tichona* Butl.
Fig. 27a. Inner (L), *Pieris rapæ* L.
Fig. 27b. Outer (L), *Pieris rapæ* L.
Fig. 28a. Inner (L), *Pyramaeis indica* Herbst.
Fig. 28b. Outer (R), *Pyramaeis indica* Herbst.
Fig. 29. Inner (L), *Diagora japonica* Feld.
Fig. 30a. Inner (R), *Papilio xuthus* L.
Fig. 30b. Outer (L), *Papilio xuthus* L.
Fig. 31. Inner (R), *Lithe sicelis* Hew.
Fig. 32. Junction of three Malpighian vessels at their terminal ends, *Phassus signifer* Wk.
Fig. 33. Longitudinal section of the blind end of vessels of *Bombyx mori* L.
Fig. 34. Malpighian vessels in the coelom just before passing into the wall of the rectum. *Papilio xuthus* L.



Naoto Ishimori



Naoto Ishimori

MYRMECOPHILES FROM THE WESTERN UNITED STATES AND LOWER CALIFORNIA

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Bureau of Entomology, U. S. Department of Agriculture.

In February, 1923, the writer made a short trip into Lower California, from Loreto to Comondù. The season was extremely dry and little insect life was seen, but beneath stones in canyons, especially toward evening, a few ants were active and among them were found two undescribed species of beetles, one of them an anomalous, blind Aleocharine that can be assigned to no known genus, the other a third species of the Histerid genus *Echinodes*.

With the descriptions of these I have included records of the host ant of several myrmecophilous beetles, with descriptions that I have had in manuscript for several years of a few new forms in the National Collection.

Pulicomorphini, New Tribe.

This new tribe belongs to the subfamily Aleocharinæ of the family Staphylinidæ and seems to be closest to the tribe Thamiaraeini. The characters given below for the genus may, for the time being serve also for the tribal characters, as the only representative of this tribe is the new genus described below.

Pulicomorpha, new genus.

Female. Robust bodied, long legged species, with broad and very deep gaster, which is carried horizontally.

Head thick in profile, subquadrate, narrower than prothorax; genæ not margined. Eyes absent. Antennæ situated in small, deep fossæ at anterior border of front, 11-jointed, first joint shortly scapiform. Mandibles very thick at base, strongly acuminate apically, the prostheca large, partly membranous and microscopically pubescent. Clypeus large, broad, nearly flat, very feebly concave at middle of anterior border. Labrum submembranous, truncate apically. Maxillary palpi 4-jointed, first joint very small; the second slender, two-thirds as long and about half as thick as the third; terminal stoutly subulate, about half as long as the third. Labial palpi 2-jointed, the basal joint a little thicker than the second and nearly equal in length. Prothorax convex above, greatly narrowed behind, hypomera not visible. Elytra nar-

rower than the prothorax, together longer than broad and broader behind than in front, with narrowly rounded anterior and broadly rounded posterior angles; scutellar borders strongly impressed, forming a profound pit which separates the elytra at the anterior half. First abdominal segment not covered by elytra, strongly chitinized; gaster as long as the remainder of body, twice as broad as elytra and, in profile, twice as thick as thorax; sides moderately margined, seven segments, subequal in length, visible from above.

Legs long and slender, middle and posterior femora arcuate and somewhat compressed; coxæ contiguous; tarsi 4–5–5 jointed, posterior metatarsus as long as the following three joints together; claws simple, long and slender.

Male. Differing from the female in its smaller size, more elongate form, shorter gaster (not as long as elytra and prothorax together) and in the shape of the head, which is proportionately much longer. Elytra longer, covering the first abdominal segment.

Genotype. *Pulicomorpha coecum*, new species.

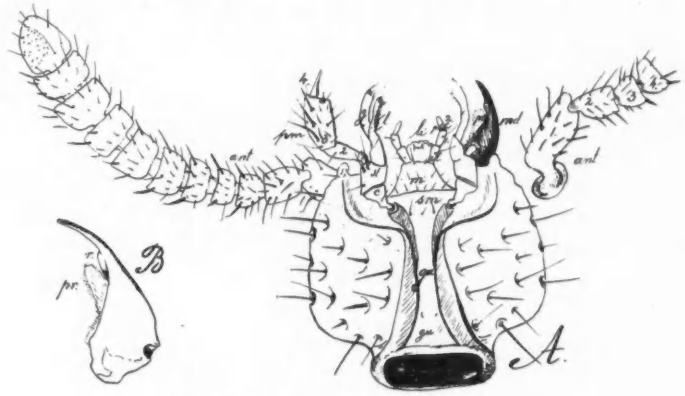

FIG. 1. *Pulicomorpha coecum*, n. sp.
A. Head from beneath. B. Mandible.

Pulicomorpha cœcum, sp. nov.

Female. Length, 1.50–1.75 mm.

Color: pale yellowish brown; shining; head, thorax and abdomen with rather widely separated, strong punctures; legs with finer, though distinct punctures; antennæ (except basal and second joints) very finely and densely punctate and opaque.

Short, silky, yellow and erect pilosity abundant on head and body, and mixed with sparse and much longer erect hairs; pilosity of legs abundant, similar to that of body, but two or more times as long and semi-recumbent.

Head barely longer than broad, sides feebly convex, occipital border rather strongly excised at middle; vertex with a short, longitudinal impression. Clypeus one and one-half times as broad as long, very feebly concave at middle of border. Antennæ stout; first joint as long as the second and third together, joints 4–10 subquadrate, broader than long and slightly increasing in width to apex; terminal joint conical, shorter than the two preceding together. Pronotum broadest at anterior fifth, strongly narrowed behind; anterior border feebly concave at sides, projecting and narrowly rounded at middle; sides convex; posterior border narrowly rounded. Elytra together longer than broad,

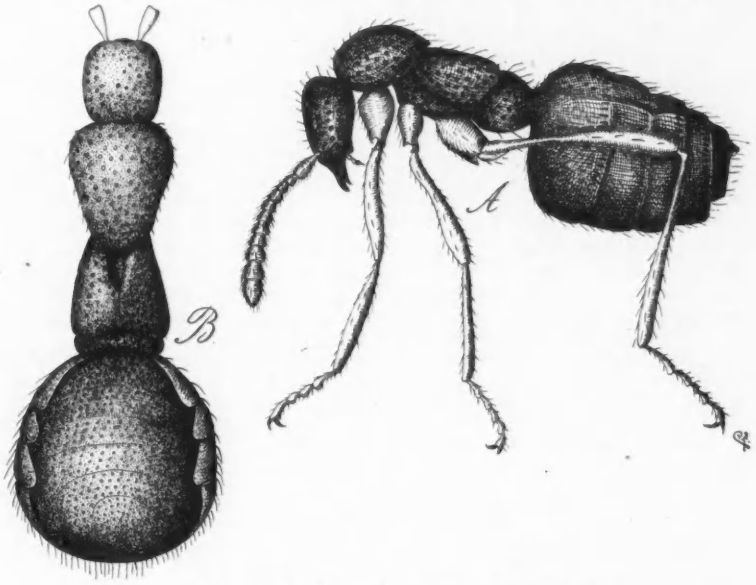

FIG. 2. *Pulicomorpha coecum*, n. sp. Female.
A. Side view. B. Dorsal view.

a little broader behind than in front, anterior corners narrowly rounded, sides nearly straight in front of middle, convex behind, posterior angles broadly rounded; posterior border broadly concave.

Male. Length, 1—1.25 mm.

Head two times as long as broad, quadrate, as broad in front as behind, with straight sides and broadly concave posterior border, in profile as long as the prothorax, which is longer and more slender than in the female.

Lower California. La Palma Davila.

Host: *Eciton peninsularis* Mann MS.

Type and allotype: Cat. No. 26492, U. S. N. M.

Described from a series of males and females taken among a cluster of the host ant found beneath a stone near a water hole.

Inquilinous insects that resemble their host ant or termite in form, size, color and even sculpture and pilosity have become almost commonplace. *Pulicomorpha*, however, adds a new category to the list of resemblances in being dimorphic, the stouter bodied, larger sized female with its short and thick head, and the more slender, smaller male, with long head, corresponding to the major and minor workers of *Eciton californicum*.

It is only in balsam mounts that the segmentation of the anterior tarsi can be made out. In dried specimens they appear five jointed, in the cleared specimens there are four distinct joints, the terminal as long as the second and third together and without trace of a suture.

Superficially *Pulicomorpha* somewhat resembles *Beyeria*, but the tarsal and palpal formulæ differ, the gaster is not pedunculate and the eyes are entirely lacking.

Pilopius ocularis Casey.

Host: *Ischnomyrmex cockerelli* André.
Garden Canyon, Huachuca Mts., Arizona (W. M. Wheeler).

Platycholeus setiger Horn.

Host: *Ischnomyrmex cockerelli* André.
Garden Canyon, Huachuca Mts., Arizona, (W. M. Wheeler).

Anchomam costatum Lec.

Host: *Crematogaster lineolata laeviuscula* Mayr.
Goldfield, Nevada.

Probably without relation to the ants other than its fondness for living in the refuse heaps in the nests.

Psiloscelis corrosa Casey.

Host: *Lasius niger americanus* Emery.
Oxbow, Sask. (F. Knab). Helena, Montana (W. M. Mann).

The distribution of the second and third known specimens of this species, described from Wyoming, shows it to be widespread, but very rare. It is undoubtedly a true ant nest beetle, like the other species of the genus. Both specimens were taken in nests of the same species of ant.

Psiloscelis abnormalis, sp. nov.

Female. Length, 6.5 mm. width, 3.5.

Form subquadrate, elongate, little convex above. Color black, legs dark reddish brown. Moderately shining.

Head behind strongly punctate, the punctures separate and those posterior longer than the others, middle portion of front with a transverse area more shining than the rest, indistinctly punctate and with several small tubercles, anterior portion of front punctate and rugulose. Basal part of mandibles coarsely punctate, apical part indistinctly so. Pronotum about twice as broad as long, slightly narrowed in front, sides at posterior half nearly straight and parallel, anterior angles narrowly rounded; surface finely and superficially punctate at middle, more strongly at sides and base; striæ very distinct, two marginal striæ, the inner fine and entire, the outer extending only on apical half, first subhumeral arcuate, extending half the distance from base to apex, second subhumeral straight, visible only at apical half (the two appearing somewhat as one, broadly interrupted stria), humeral short and oblique, discal striæ 1–4 simple, entire and slightly curved, 5th roundly connected at apex with the 6th, which is similarly joined at base with the sutural. Propygidium and pygidium foveolately punctate. Prosternum without distinct margin. Ventral surface foveolately punctate, the metapleuræ much more coarsely than the other parts. Anterior tibiæ at tips more than half as broad as long, the outer margins with four large, short, blunt denticles. Outer margins of middle and posterior tibiæ with 7–10 coarse, elongate spines.

North Dakota; University (June), R. P. Currie.

Type No. 26493, U. S. N. M.

Described from a unique female. This species is most probably myrmecophilous in habit like the others in the genus, though no host ant accompanies the specimen. In its elongate form and feebly convex dorsum it resembles *corrosa* Casey, from which it differs in its much larger size and the distinct striation on the elytra.

There is, in the specimen before me, a curious abnormality in the elytral striation. The description is based on the right elytron, which is evidently normal. On the left the third sutural stria is forked at apex, the 4th, 5th and 6th are united at base and near the apex of the 6th there is a short, diagonal stria extending forward and outward almost reaching the 5th.

Echinodes setiger Lec.

Host: *Pheidole dentata commutata* Mayr.

Harrisburg, Texas (H. S. Barber).

Mr. Barber collected two specimens beneath a log, with the host ant.

Echinodes decipiens Horn.

Host: *Pheidole* sp.

Kerryville, Texas (F. C. Pratt).

The unique specimen in the National Collection is accompanied by a worker and a female ant.

Echinodes peninsularis, sp. nov.

Length, 1.60 mm.

Broadly oval and convex, brownish red, shining; dorsum with regular, rather coarse setose punctures on the pronotum, the surface between with fine elongate punctation, like very short striæ.

Front of head at middle elevated as a broad, low and rounded carina, separated from sides by strong deep furrows, and with a transverse groove at base of clypeus. Clypeus nearly flat, not greatly enlarged apically, with the front border very feebly concave. Pronotum nearly three times as long as broad, anterior border emarginate; sides convex and gradually narrowing to apex, margin of elytra continuous with the thorax. Six elytral striæ fine, but very distinct, with rows of fine punctures on either side; sutural area impressed at middle of disc, striæ indicated by rows of coarse punctures. Propygidium and pygidium finely punctate and setigerous. Prosternal lobe evenly rounding into the basal portion not separated by a transverse furrow; striæ widely separated at base, only moderately convergent anteriorly. Surface of mesosternum shallowly concave; punctures sparse and fine. Metasternum finely and evenly punctate. Tibiæ with coarse, short setæ on surface and outer margin.

Baja California; Las Parras. Host: *Pheidole hyatti* var.

Type: Cat. No. 26494, U. S. N. M.

Described from a unique specimen taken toward evening with the host ant in a nest beneath a stone.

This species is distinct from both *setiger* Lec. and *decipiens* Horn in the structure of the prothoracic lobe, which is much less abrupt and not separated from the base by a transverse suture. The mesosternum, with concave surface very feebly carinate at middle and finely punctate, also differs from the latter two species, the first of which has the surface abundantly and strongly, and the second sparsely but equally strongly punctate.

Hetærius zelus Fall.

Host: *Formica cinerea pilicornis* Emery.
Pasadena, California.

Hetærius strenuus Fall.

Host: *Formica fusca argentea* Wheeler.
Santa Cruz Mts., California.

Hetærius hubbardi, sp. nov.

Length, 2 mm.

Near *H. schwarzi*. Reddish brown, shining. Head with punctures rather strong, especially on the vertex. Disc of pronotum finely punctate, impressed areas at sides of base microscopically rugulose and opaque; lateral portion with a few strong punctures and a series of eight wavy, interrupted longitudinal carinæ; posterior lobed portion (in the type specimen) entirely lacking, represented by two deep incisions.

Elytra together broader than long, punctures moderately abundant and coarser than those of pronotum; striæ as in *schwarzi* but less strongly carinate. Propygidium and pygidium coriaceous, sparsely and finely punctate.

Prosternum coarsely and densely punctate and opaque, marginal striæ converging at half the distance from base to apex.

Meso- and metasternum finely punctate and shining. Legs as in *schwarzi*.

Arizona, Oracle. Jan. (Hubbard and Schwarz).

Host: *Formica* sp. (in bad condition).

Type: Cat. No. 26495, U. S. N. M.

The hairs in the type specimen have nearly all been rubbed off, the few remaining are short and stiff.

The specimen has been in the National Collection for many years and has been seen by a number of Coleopterists, who differ in opinion regarding the excised posterior portions of the pronotal margins. I think it probable that the specimen is abnormal, but perhaps the lobes were bitten off by the ants while the beetle was in a soft condition. In that case it was a very neat dissection, for the excisions are quite symmetrical.

In addition, *hubbardi* differs from *schwarzi* in its much finer punctation, more abundant carinulæ on the prothoracic marginal pieces and in the striae which separate this portion from the disc. In *schwarzi* there are two striae, both complete, in *hubbardi* the inner becomes obsolete at half the distance from base to apex.

Hetærius schwarzi, sp. nov.

Length, 2.25 mm.

Dark reddish brown. Form broadly oval.

Head rather coarsely and irregularly punctate, the punctures on anterior portion of front fossulate and more approximate than those posterior. Clypeus twice as broad as long, its surface concave at middle; anterior border slightly convex. Pronotum twice as broad as long; disc shining, strongly punctate, anterior border more densely punctate and coriaceous between; marginal portion impressed at basal third, the anterior portion coriaceous and with coarse, fossulate punctures and strong, irregular longitudinal carinæ, posterior portion gibbous toward inner margin, surface fossulately punctate, with one entire and acute longitudinal carina. Elytra together broader than long, coarsely punctate, the punctures irregular on mesal portion and arranged in rows between the striæ; humeral and marginal striæ entire, first discal stria entire, second and third extending five-sixths the length of elytra, all rather sharply carinate. Propygidium and pygidium coriaceous, moderately shining, with a few punctures, finer than those of elytra. Prosternum densely punctate and opaque, the lateral marginal lines converging at five-eighths the distance from base to apex; transverse impression anterior to this very feeble.

Meso- and metasternum moderately shining, finely and sparsely punctate. Legs strongly punctate, anterior tibiæ about one-third as broad as long, denticulate at outer border.

Arizona; Oracle. Apr. (Hubbard and Schwarz).

Host: *Formica rufibarbis gnava* Buckley.

Type: Cat. No. 26496, U. S. N. M.

The single specimen in the collection is badly rubbed. There is a sparse fringe of stiff yellow hairs on the prothoracic margin and scattered, erect and rather short hairs on pronotum and elytra. Judging from the arrangement and abundance of punctures, fresh specimens are thickly pilose. Some of the hairs on the elytra are longer than the others, thick basally and fine and flexuous apically.

This and the preceding species are large, more robust and more strongly punctate than any of the Western species except those of the *tristriatus* group, and are related more to *blanchardi*.

DIPTERA, SYRPHIDÆ.

Microdon newcomeri, sp. nov.

Male. Length, 11 mm.

Color dark blue, with violaceous lustre, especially on abdomen; tibiæ and tarsi brown. Frons distinctly broader than long, narrowed in front to posterior third of eyes and at narrowest place one-half as

broad as the face; transverse furrow arcuate, moderately distinct. First antennal joint dark brown, as long as the other two joints together; second and third joints black, the second one third as long as the first and twice as broad distally as at base; third joint thickest at middle, rather broadly rounded at apex; arista coarse, three-fourths as long as third joint. Mesonotum broad and flat. Scutellum unarmed, twice as broad as long, posterior margin truncate at middle. Abdomen elongate oval, broader than thorax. Wings moderately broad, hyaline, veins brown; posterior angles of first posterior and discal cells produced and rounded. Halteres and tegulæ honey yellow.

Head and thorax very densely covered with short, erect, black hairs which are longest on scutellum and humeri. Hairs on legs black, shorter and semi-recumbent. Abdomen with microscopic, semi-recumbent white hairs.

Portola, California, April 30, 1910 (E. J. Newcomer).

Type: Cat. No. 22726, U. S. N. M.

Near *modesta* Knab, but differing in color, metallic lustre and in having the posterior border of the scutellum truncate.

The pilosity on the abdomen is discernible only under a high power lens.

THE FAMILY NAME OF THE LACE-BUGS (TINGITIDÆ)

W. J. Holland,
Carnegie Museum.

A discussion as to whether the form *Tingidæ* or *Tingitidæ* should be used as the family-name of the "Lace-bugs," (See Science, Vol. LVI, pp. 334, 449, 535, 603, 754) has taken place. I observe that in the last issue of the Zoological Record, Insecta, p. 241, the form *Tingitidæ* is employed. The majority of scholars have elected in practice to employ the latter form, and this usage appears to the writer, who is not merely an entomologist, but a linguist, to be altogether preferable, and accordant with the teachings of sound philology and the International Code of Nomenclature.

Fabricius was the first to employ the word *Tingis* as a generic term, evidently having in mind the ancient name for Tangiers. The genus preceding *Tingis* in his "Systema Rhyngotorum" is *Syrtis*, and a large number of the other generic names adopted by him are the names of localities, *e. g.*, *Lystra*, *Derbe*, *Iassus*, *Canopus*, *Edessa*, *Cydnus*, etc.

According to the International Code of Nomenclature the rule is that in forming family-names the patronymic termination "*idæ*" should be suffixed to the stem of the word. The stem of Latin words is

easily found by subtracting the inflexional ending of the genitive. As an illustration let us take the Latin noun *Elephas*, an elephant; genitive *elephantis;* remove the inflexional ending "*is*" and the residuum is the stem, *elephant;* suffix to this "idæ" and we have the family name *Elephantidæ*.

Now the only question in the case of the genus *Tingis* is what is the stem of the word. On the reasonable presumption that Fabricius had in mind the ancient name for Tangiers, when he first employed the generic term, we are forced to ascertain what is the stem of the word in the Latin language. No instance of the use of the genitive is so far known in the body of Latin authors and inscriptions. But we have a positive indication of what the genitive was in the adjectival form *Tingitanus*. Latin adjectives are formed in the same way as Latin patronymics by suffixing the adjectival ending to the stem of the word. In the case of *Tingitanus* before us the ending "*anus*" is suffixed to *Tingit*, the stem. This shows that the genitive used by the Latins must have been *Tingitis*, TINGIT being the stem. Suffixing "*idæ*" we have TINGITIDÆ, the family name for the insignificant, but highly interesting lace-bugs.

Against what has been hereinbefore set forth is the claim that Fabricius in the footnotes in his "Systema Rhyngotorum" has given the genitive forms of the nouns he employed, and used *Tingis* as the genitive of his generic name. It is only *partially* true that Fabricius gave the genitive of the nouns he employed as generic terms. Take the noun *Derbe* as an illustration. He treats this noun as if indeclinable and gives it in its nominative form in his footnote. But the genitive of *Derbe* is *Derbes* (*Cf.* any Latin dictionary). He gives the nominative form *Halys* in his footnote under that genus, but the genitive is *Halyos* (*Cf.* Latin dictionaries), etc. It is evident that Fabricius did not take the trouble to look up and ascertain what is the true genitive of a number of the words he used. He was a little careless. He made a mistake in giving "*Tingis*" as a genitive, as he did in the foregoing and a number of other cases. He had no more right to change the Latin language than any other man has. Fabricius overlooked the fact that he should have used *Tingit-* instead of *Ting-* as the stem of the noun he was employing. He made a grammatical error, and recent entomologists have done right in correcting it. The laws of priority do not have precedence over the laws of correct language.

MORPHOLOGY OF THE PROLEGS OF TRICHOPTEROUS LARVÆ*

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In a previous paper (Krafka, 1923) the Leptoceridæ were taken as the stem form in the order Trichoptera on the basis of the structure of the larval heads. If this hypothesis be correct, some degree of correlation should be found in the development of the organs of the thorax and abdomen. These studies have been made and much confirmatory data has been found. On the basis of the new phylogeny, the homologies of the schlerites of the prolegs, caudal hooks or dragging-hooks becomes relatively simple.

STRUCTURES OF THE THORAX.

1. Chitinization of the Pronotum, Mesonotum and Metanotum: The pronotum is chitinized in all of the families and affords little information. The mesonotum is either membranous or little chitinized in the Leptoceridæ. The Molannidæ have a broad plate on the mesothorax, the Phryganidæ have a pair of small circular bristle-bearing plates; while the Odontoceridæ and the Limnophilidæ have the mesothorax completely chitinized dorsally. The Sericostomatinæ have a broad dorsal plate which is heavily chitinized anteriorly, but which gradually vanishes into a membrane at the posterior margin of the segment. The Brachycentrinæ have two or three pairs of broad plates articulating laterally. The Lepidostomatinæ have a broad flat plate with a median longitudinal suture, while the Goerinæ have two pairs of sub-equal plates arranged in a transverse row.

With very few exceptions the mesothorax of campodeoid larvæ is membranous.

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* Contribution from the Zoological Laboratory of the University of Georgia, No. 3.

The metanotum is membranous in the Leptoceridæ. In the Molannidæ two small bristle-bearing plates are present. The Phryganidæ show the same structure, while the Calomoceratidæ bear four of these small flecks. Two pairs of chitinous plates practically cover the metathorax in the Odontoceridæ. The median pair are short and broad; the one is just caudad of the other. The lateral pair are subquadrate in shape and one is laterad to either end of the median pair. The Limnophilidæ show three pairs of characteristic plates. The smallest pair is cephalic and median in position; the second pair is caudad and laterad, while the third large pair are markedly laterad. The first two pairs are circular disks, while the third pair are cresentic in outline.

Among the campodeoid larvæ, the Hydroptilidæ, Hydropsychidæ and the Ecnominidæ have both the mesonotum and the metanotum chitinized. The plates are broad and single, in nearly all cases. In all other campodeoid larvæ the metathorax is membranous.

In conclusion, the Leptoceridæ are strikingly like the majority of campodeiform larva, while the eruciform show an advancing chitinization in keeping with the general scheme of the new phylogeny.

2. Prosternal Horn: In some of the eruciform larvæ a very peculiar chitinous spine or horn protrudes ventrally from the prosternum. It is present in the Phryganidæ, and highly developed in the Limnophilidæ, Lepidostomatinæ, and Goerinæ. It is absent in the Leptoceridæ, Molannidæ, Sericostomatinæ, Brachycentrinæ, Odontoceridæ, and Calamoceratidæ. Likewise it is entirely absent from the campodeoid larvæ.

3. Anal Gills: Anal or rectal gills are present in the various campodeoid larvæ and in the Leptoceridæ, indicating again a very close relationship between the two. The presence of them in these particular families questions the theory that they are highly specialized structures.

4. Other Structures: The abdominal tubercles, lateral line, and tracheal gills are present in the eruciform and absent in the campodeoid larvæ and hence of no phylogenetic significance. Tracheal gills do occur in the Rhyacophilidæ and the Hydropsychidæ.

STRUCTURE OF THE PROLEGS, CAUDAL HOOKS OR DRAGGING HOOKS.

The prolegs have given considerable difficulty in all attempts to homologize them. While those of the eruciform are comparatively simple, those of the campodeoid group show a wide range of variation. Some investigators have described them as two or three segmented, while even as many as four segments have been made out in the Polycentropidæ.

The progressive development of the prolegs, when considered in connection with the new phylogeny simplifies the problem considerably, since it leads to a search for the prototype in the Leptoceridæ, and not in the Rhyacophilidæ as heretofore.

Throughout the eruciform group there are ten abdominal segments of more or less equal size. The ninth, (except in a few Leptoceridæ, where it is membranous), bears on its dorsal posterior margin a plate, supplied with numerous heavy bristles. The anal opening is on the tenth, and more or less bisects this segment. A pair of so-called prolegs, dragging hooks or caudal hooks are found in a posterior laterad position on the respective sides of this segment. The claws are free at their distal ends, but have proximal insertions into supporting plates.

These basal plates vary considerably in chitinization, shape and position. Although weakly chitinized in the Leptoceridæ, this plate covers the dorso-lateral angles of the segment like a cuff. The hooks or claw articulates on three sides with this plate, while its medial margin is free, thus permitting movement in a lateral plane. (Fig. 1). A small articular plate is present between the claw and supporting plate. This supporting plate bears on its margin a number of posteriorly directed bristles.

The entire eruciform group offer no particular difficulties as they vary but little from the Leptocerid condition. (Figs. 2, 3, 4, 5, 6, and 7).

A dorsal view of the prolegs of Hydroptilid I (Fig. 8) shows essentially the same features as that of the eruciform larva. A dorsal plate on Segment IX bears bristles, while Segment X is a fleshy segment, bearing at its latero-caudad angles the hooks supported by the cuff-like articular plates. (Fig. 9).

Mystrophora americana (Glossosomatid) again shows the same parts. Segment IX bears the dorsal plate as usual. Segment X is fleshy, and while its latero ventral angles project

beyond the median caudal point the relative position of the hooks are still the same. The basal cuff-like plate is long and large as compared to that of any eruciform, and it constricts the fleshy region to form a projecting structure beyond the general surface of the segment. Posterior and ventral to the plate of Segment IX is the anal opening through which the rectal gills are protruded. The segment has the appearance of an eruciform type in which the hooks have been forcibly drawn out, stretching the attachment plates and the membranes into a finger-like process. (Figs. 10 and 11).

The Rhyacophilinæ have a very complicated appearance. The prolegs are long and slender, and widely separated, bringing the anal opening immediately behind Segment IX, which is recognizable by the dorsal bristle bearing plate. The cuff-like attachment plates of the prolegs are large and well developed. They lose their simple contour and are extended at the dorso-lateral angles into long projecting spurs. In previously discussed types the hooks moved in a horizontal plane. In the Rhyacophilidæ and the remainder of the campodeoid group they assume a vertical position. In the Rhyacophilidæ, a dorsal intercalated plate is present as well as a ventral one. The hooks themselves are longer and more evenly curved, and are without the small points or "ruckenhacken." In some cases small secondary or accessory hooks are found at the base of the articulary plate. Their action is in opposition to the larger caudal hooks. (Fig. 12).

In the Philopotamidæ the prolegs are even longer and more flexible. The Segment X is greatly reduced in length, being divided almost to the IX Segment. The anal opening and the rectal gills may still be identified with this segment. (Fig. 13). The prolegs of Chimarrha have been described as 3- or 4-segmented. They represent, however, the same conditions as those of the Rhyacophilidæ. The proximal half of the proleg is membranous or fleshy. The median aspect of the distal half is also membranous, while the dorso-lateral aspects are covered by the semi-cylindrical articulating plate, thus giving the appearance of two segments, while the claw is itself considered the third.

This condition is even more apparent in the Polycentropidæ where the cuff-like articulating plate nearly surrounds the proleg. In this case only the extreme ventral portion is left

membranous, but it is clearly continuous with the proximal fleshy portion, and does not represent a new segment. (Fig. 14). Striking evidence is found in Phylocentropus, where an exceptionally long proleg exists. It is totally membranous with the exception of the hook and the short, dorsal bristle-bearing plate, the position of which makes it readily recognizable as the articulating plate of the other families. (Fig. 15).

In the Hydropsychidæ the same conditions exist. The dorsal bristle-bearing plate of the IXth segment is represented by a pair of small plates. Segment X is of considerable size, and bears the anal opening and the rectal gills. The prolegs are long and finger-like; their median lateral borders are membranous and continuous with the fleshy portion of the segment. The cuff-like plate extends from the dorso-median line to the ventro-median line, thus covering the latero-mesad aspect of the posterior portion of the pro-leg. It bears a large number of stiff bristles at its posterior margin. The hooks are relatively small. (Figs. 16 and 17).

It is thus possible to bring the rather peculiar dragging hooks of the campodeoid larvæ into a close comparison with the simple case hooks of the eruciform group. The function of the two are entirely different. The case hooks of the eruciforms are for the sole purpose of retaining the larva in the case, while the dragging hooks of the campodeoids are ambulatory appendages.

GENERAL DISCUSSION.

The foregoing data lend cumulative support to the phylogeny as previously established. The chitinization of the mesanotum and metanotum varies from membranous in the Leptoceridæ to entire covering plates in the higher eruciforms. Likewise the various subgroups in the campodeoids differ from a condition like that of the Leptoceridæ to entire covering plates.

The anal gills definitely associate the Leptoceridæ with the campodeiforms, while the abdominal tubercles, lateral line, tracheal gills, and prosternal horn offer no difficulties.

A careful study of the dragging hooks of the campodeoid larvæ show them to be greatly elongated lateral outgrowths of the tenth abdominal segment, instead of appendages of the ninth. This offers a simpler explanation than the assumption on the basis of the older phylogeny that the Xth segment of

the eruciforms represents the fused prolegs of the campodeiform larvæ. It also brings the Hydroptilidæ and the Glossosomatinæ into a more consistent position.

Independence in larval and adult evolution has long been recognized. Many larval characters are considered adaptive to that stage alone, but a general parallelism in development is to be expected between larval and adult phylogeny. Yet the Rhyacophilidæ, while possessing the hypothetical wing type of Comstock, and a divided sub-costa as shown by MacGillivray, have larvæ that are specialized in many respects.

Furthermore, while the campodeoid larvæ are considered generalized in many orders of insects, they can no longer be so in Trichoptera, and the general practice of associating primitiveness with that particular form of larva is largely questioned.

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EXPLANATION OF PLATES.

All figures are drawn with aid of camera lucida. The magnification varies as an attempt was made to have all figures about the same size.

Abbreviations used in lettering the figures:

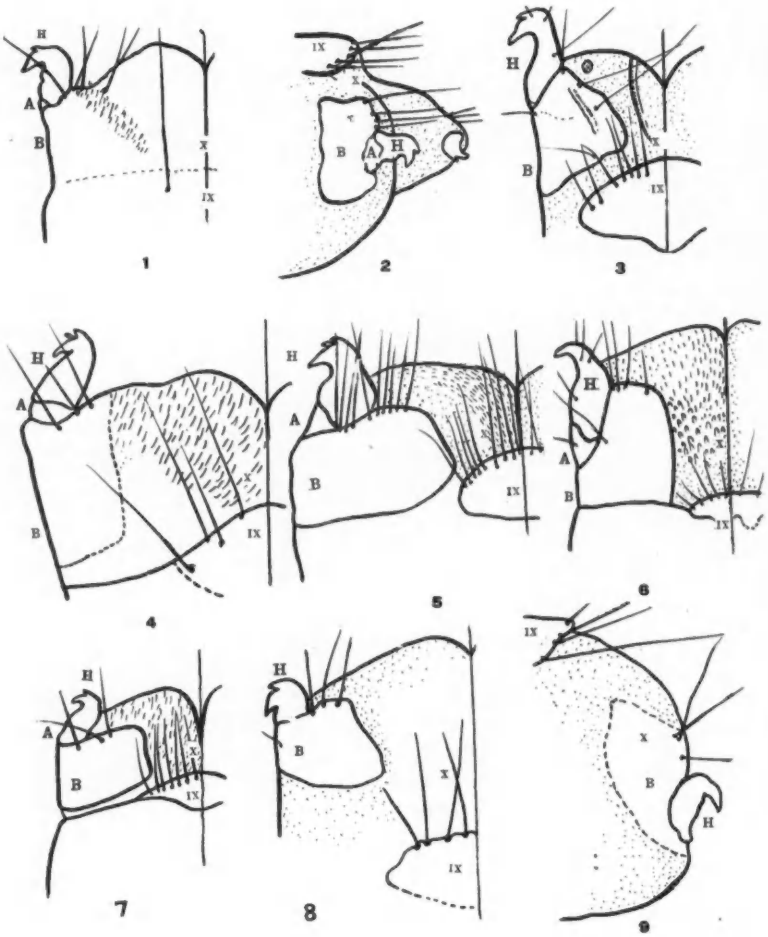
IX—ninth abdominal segment.
X—tenth abdominal segment.
H—hook.
A—articular plate.
B—basal supporting plate.

PLATE XVI.

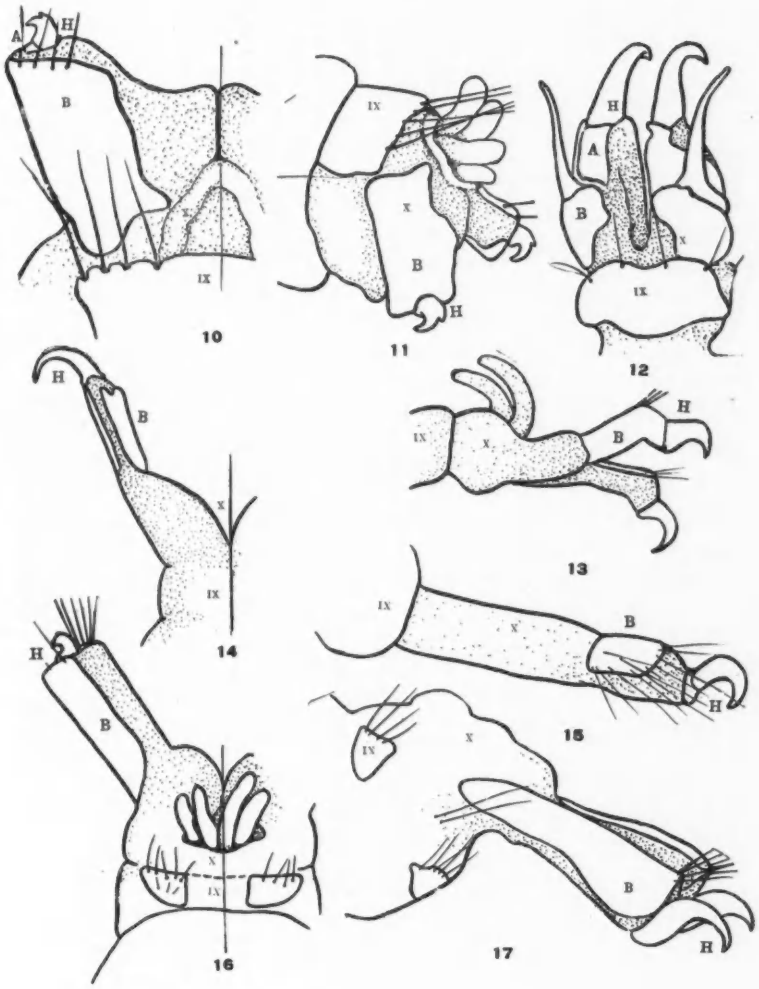
Fig. 1. *Leptocella uwarowii* Kol. Dorsal aspect of the proleg.
Fig. 2. *Molanna II* (Cold Spring Harbor). Lateral aspect of the prolegs.
Fig. 3. *Ganonema americanum* Walk. Dorsal aspect of proleg.
Fig. 4. *Neuronia* 5. Dorsal aspect of proleg.
Fig. 5. *Brachycentrus nigrosoma* Banks. Dorsal aspect of proleg.
Fig. 6. *Psilotreta frontalis* Banks. Dorsal aspect of proleg.
Fig. 7. *Arctoecia medialis*. Dorsal aspect of proleg.
Fig. 8. *Hydroptilid* I (Betten). Dorsal aspect of proleg.
Fig. 9. *Hydroptilid* I (Betten). Lateral aspect of proleg.

PLATE XVII.

Fig. 10. *Mystrophora americana* Banks. Dorsal aspect of proleg.
Fig. 11. *Mystrophora americana* Banks. Lateral aspect of prolegs.
Fig. 12. *Rhyacophilid* I, Tolon, Colo. Dorsal aspect of prolegs.
Fig. 13. *Chimarrha* sp. Ithaca. Lateral aspect of prolegs.
Fig. 14. *Polycentropid* I, Cold Spring Harbor. Ventral aspect of proleg.
Fig. 15. *Phylocentropus* sp. Lateral aspect of proleg.
Fig. 16. *Hydropsyche incommoda*. Dorsal aspect of prolegs.
Fig. 17. *Hydropsyche* 27006, Ill. Lab. Nat. Hist. Lateral aspect of prolegs.



Joseph Krafka, Jr.



Joseph Krafka, Jr.

SPECIES OF SUBGENERA COLLINELLA AND LEPTOCERA OF NORTH AMERICA*

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State College of Washington.

The subgenus *Collinella* Duda is one of the larger subgenera of the genus *Leptocera* Olivier. It includes several of our more common species that occur both in North America and Europe. The individual members of this subgenus can be easily recognized by the presence of a preapical and absence of an apical bristle on middle tibia and by the presence of well developed dorsocentral bristles. Some workers in this group have failed to recognize these characters. Where the writer has not had recourse to type material, the placing of some of these species proved very difficult.

This paper is one of a series of papers attempting a revision of the North American species of the Family *Borboridæ*. It is hoped that this paper will aid in bringing about a better understanding of the group.

Unless otherwise designated the type material is in the Melander collection.

Dr. O. Duda, in his Revision of the European Species of *Limosina*, erected a number of subgenera, but failed to give the name *Leptocera* (*Limosina*) to any of these subgenera which according to the international rules of nomenclature must be done. According to the description of *L. nigra*, the genotype for *Leptocera*, this species comes within Dr. Duda's new subgenus *Paracollinella*. The name *Leptocera* should therefore be substituted for *Paracollinella*.

Subgenera Collinella and Leptocera.

Face vertically sinuose in profile, tuberculate or carinate at antennæ; posthumeral bristles present.....**Collinella** Duda

Face concave in profile, not tuberculate at antennæ; posthumeral bristles absent.....**Leptocera** Oliv.

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* Contribution from the Division of Entomology of the Agricultural Experiment Station, State College of Washington.

Species of Collinella.

1. Scutellum with eight marginal bristles, third pair encroaching upon the disc to a greater or less degree; disc with two strong bristles and a number of irregular setæ 2
   Disc of scutellum bare 3
2. Wings narrow, tapering apically, grayish; discal cell long and narrow; middle acrostichals rather long; front, face, and cheeks black; face broadly carinate above, very slightly concave in profile; halteres whitish; scutellum long triangular. Fig. 3 ..... **echinaspis,** n. sp.
   Wings broad, distinctly brownish; discal cell normally broad; lower front and divergent stripes reddish; cheeks fuscous; scutellum broadly triangular; halteres yellow; middle acrostichals weaker. Fig. 10. **fuscipennis** Hal.
3. Wings decidedly browned, or with distinct brown spots either on the veins or on the disc 4
   Wings hyaline or with but faint indications of fuscous suffusions along the veins, never distinctly spotted 8
4. Notum with distinct vittæ 5
   Notum without such markings 6
5. Wings marked with dark brown infuscations along all veins, a broad area over last section of second vein, inner and outer crossveins to near lower wing-margin and a broad band across wing near apex; face produced; lower two pairs of interfrontal bristles long and cruciate; notum with four grayish white vittæ. Fig. 4 ..... **trigonata,** n. sp.
   Wings with disc clear, dark brown infuscations extending along all veins only; notum with four fuscous vittæ; face produced; interfrontal bristles in four pairs, the lower two pairs long and cruciate. Fig. 7 .. **fumipennis,** n. sp.
6. Wings dark smoky brown, with the greater portion of the first basal cell, the anterior and middle of discal cell, a long slightly curved stripe in the middle of marginal cell and a large crescent-shaped mark beyond the discal cell, subhyaline; discal cell broad; scutellum with six marginal bristles, the basal pair setæ-like; dorsocentral bristles in five pairs; incurved acrostichal bristles strong; abdomen short and broad. Fig. 2 ..... **frosti** Johnson
   Wings not so marked; scutellum with eight marginal bristles 7
7. Disc of wing with dark brown markings at apex, along costal border and over inner and outer crossveins; veins not distinctly infuscate; legs black; halteres white. Fig. 9 ..... **schildi,** n. sp.
   Disc of wing clear, with heavy dark brown markings along all or most of the veins, especially outer crossvein; legs yellow; halteres brown, **fuscinervis** Mall.
8. Scutellum with six marginal bristles, the basal pair very small; interfrontal bristles in four pairs, the upper two pairs weak, the lower two pairs very strong; outer angle of discal cell short appendiculate; halteres with stalk fuscous and knob yellow. Fig. 8 .. **limosa** Villen-Duda
   Scutellum with eight marginal bristles 9
9. Scutellum with several setulæ on margin of disc in addition to the marginal bristles; outer crossvein at distinctly before end of second vein; face and cheeks brownish; halteres yellowish ..... **marginalis** Mall.
   Scutellum with only marginal bristles present 10
10. Notum with three distinct fuscous vittæ; dorsocentral bristles in three pairs; posthumeral bristles strong, incurved; acrostichal bristles absent; arista more than three times antennal length; third antennal joint yellow; legs fuscous; upper and lower pairs of interfrontal bristles weak, the middle two pairs long and cruciate; halteres pale yellow. Fig. 13 ..... **trochanteratus** Mall.
    Notum without vittæ or with but faint indications of markings 11
11. Outer angle of discal cell usually rounded; halteres yellow 12
    Outer angle of discal cell not rounded, usually more or less appendiculate ... 13

12. Large, opaque, black to brownish species (4 mm.); front opaque; frontal triangle extending to lower margin of front; facial tubercle strong, blunt, dorsocentral bristles in four pairs; hind trochanter in the female with short, thickened bristles; second anal segment in male with short, blunt, slightly curved processes. Fig. 1 ..... **lutosa** Stenh.

Smaller species (3 mm.); dorsocentral bristles in three pairs; hypopygium normal; wings clear, veins brown, halteres clear yellow.... **breviseta** Mall.

13. Halteres black; fifth vein usually produced beyond outer crossvein; dorsocentral bristles in three to four pairs; acrostichal bristles on anterior half of mesonotum strong; interfrontal bristles in four pairs, increasing in size anteriorly, the anterior two pairs cruciate. Fig. 5 **atra** Adams

Halteres entirely or for the most part yellow; fifth vein not extending beyond outer crossvein 14

14. Shining black species (1 mm.); front with a velvety black M-shaped mark; hypopygium small, yellowish; legs brown with knee joints, bases of femora and tarsi yellowish; wings brownish; veins brown; halteres entirely yellow ..... **M-nigrum** Mall.

Slightly shining species (2.5 mm.); front entirely shining; hypopygium large; legs black-brown; wings clear, veins black; postnotum glossy black; halteres with knob yellow and darkened pedicel.. **subpiligera** Mall.

Leptocera (Collinella) **echinaspis,** n. sp. (Fig. 3).

Opaque black. Front almost flat, with setigerous stripes and frontal triangle slightly shining; bristles well developed; fronto-orbital bristles nearly equal in size; orbital setulæ in two distinct pairs; interfrontal bristles in three pairs, increasing in size anteriorly, the anterior pair meeting but not crossing; two pairs of interfrontal setulæ present below anterior pair of interfrontal bristles; ocelli slightly reddish; ocellar tubercle not strongly developed, faintly gray-dusted; face carinate, slightly concave in profile; clypeus narrowly visible from in front; cheeks at vibrissal angle, one-fourth as high as eye; oral vibrissæ strong; oral setæ distinct; buccal bristles in two pairs, the anterior pair considerably stronger than the other; antennæ widely divergent; second and third joints nearly equal; arista less than two times antennal length, with microscopic pubescence. Mesonotum with five pairs of dorsocentral bristles, in widely divergent rows; acrostichal setulæ in eight rows between anterior pair and four rows between the posterior pair of dorsocentral bristles, middle acrostichals much longer than the others; posthumeral bristles present, incurved, nearly meeting at the tips; scutellum triangular; marginal bristles very long, eight in number; disc with two strong bristles and a number of irregular setæ; pleuræ brownish; sternopleuræ with two bristles on upper portion, the posterior bristle much longer than the other. Legs pale brown, bristly, with coxæ yellow; front femora with long hair-like bristles; middle coxæ with two moderately strong bristles; middle trochanter with a strong bristle; middle femora with a row of four distinct setæ on apical third of anterior side; middle tibiæ with eight extensor bristles, two pairs before middle and two pairs on apical third; hind tibiæ with a double row of long hair-like bristles; hind metatarsi depressed, three-fourths as long as second joint. Wings hyaline, narrow; veins pale

brown; costa darker, ending at third vein, first section bristly, equal to third and two-thirds as long as second; basal section of third vein slightly shorter than the distance between cross-veins, two and one-half times outer cross-vein and two-fifths as long as the last section of second vein; third vein distinctly curved up on its last section; fourth vein faintly traceable to wing-margin; discal cell long and narrow. Abdomen two-thirds as long as thorax, narrow; second segment as long as the next two. Halteres white. Length 1.5 mm.

Type. Male; Salt Marshes, Palo Alto, California, April 20, 1906 (Aldrich).

Leptocera (Collinella) **fuscipennis** Haliday (Fig. 10).

Haliday: Ent. Mag. 1, 178, (1833); III, 332 (1836). (*Limosina.*)
Duda: Abhand. Zool-Botan. Ges. Wien. X, 1, 54 (1918). (*Limosina*).
oelandica Stenhammar: Coprom. Scand. 391 (133) 18 (1855). (*Limosina*).
pleurisetosa Strobl: Wien. Ent. Zeitg. XIX, 69, 352 (1900). (*Limosina*).

Three specimens from Chicago, Ill., and Cold Spring Harbor, N. Y. (Melander).

Leptocera (Collinella) **trigonata,** n. sp. (Fig. 4).

Opaque black to slightly shining. Front but little broader than high, slightly slivery pollinose on frontal triangle, orbital stripes and interfrontal stripes; interfrontal bristles well developed, in four pairs, the anterior three pairs cruciate, the anterior two pairs much longer than the others; orbital bristles strong, the anterior bristle but little more than one-half as long as the posterior; the third joint of antennæ considerably larger than second, much broader than long, covered with minute whitish pubescence, second joint with a number of stiff bristles on apical margin; arista two and one-half times antennal length with long pubescence; face tuberculate, vertically sinuose in profile; mouth margin slightly curved up; clypeus narrowly visible from in front; cheeks one-fifth as high as eye. Mesonotum brownish with four distinct grayish white vittæ; dorsocentral bristles in three pairs, posthumerals present; acrostichal setulæ numerous, the posterior pair of middle row developed bristle-like; scutellum large, triangular, marginal bristles eight, the third pair from the base encroaching upon the disc; pleural sutures yellowish; sternopleuræ bristle well developed, the posterior bristle much stronger than the anterior. Legs with bristles well developed; hind metatarsi two-thirds as long as following joint, but slightly enlarged; middle tibiæ with ten strong extensor bristles and the typical flexor preapical bristle; front tarsi slightly incrassate. Abdomen short, cylindrical, hypopygium large. Halteres clear yellow. Wings as in Fig. 4. Length 3 mm.

Type. Male; Turrialba, Costa Rica, Pablo Schild, Collector (Melander collection).

Paratypes. One male and one female from the same collection.

Leptocera (Collinella) **fumipennis,** n. sp. (Fig. 7).

Opaque black. Front convex, much broader than deep, with the divergent stripes, divided by the broad interfrontal stripes, black; head bristles quite strong; fronto-orbital setulæ weak, not produced above upper fronto-orbital bristle; interfrontal bristles in three pairs, the upper pair moderately strong, the other two very long, and cruciate; a single pair of interfrontal setulæ present; face and cheeks fuscous; face tuberculate, not concave in profile; cheek at vibrissal angle, one-fourth as high as eye; oral setulæ rather long, hair-like; buccal setæ in two pairs, stiff, curved up; antennæ widely divergent, the third joint but little larger than second, with white pubescence; arista short, two times antennal length, with short dense pubescence. Mesonotum with five distinct fuscous vittæ; dorsocentral bristles in four pairs, the anterior pair quite weak, others strong, the posterior pair very strong; discal setulæ weak, irregularly arranged; two rather strong acrostichal bristles between the anterior two pairs of dorsocentral bristles; posthumeral bristles strong; scutellum large; disc bare, margined with eight bristles, the basal and third pair from base weaker, the others very long; sternopleuræ with a strong posterior bristle and a weak anterior seta. Legs fuscous, with trochanters, middle and hind coxæ, apices and bases of femora, tibiæ and tarsi yellowish; middle trochanter with a small bristle, middle femora with a row of five setæ on the apical half of anterior side, the apical one much stronger than the others, bristle-like; middle tibiæ increasing in size apically, slightly bent at apical third; extensor surface with ten bristles, five before and five beyond middle; flexor surface with one bristle at middle and one before apex; first joint of middle tarsi with a distinct bristle beneath; hind tibiæ with some hair-like bristles on outer side, hind metatarsi two-thirds as long as next joint. Wings with fuscous suffusions along all veins; costa ending considerably before wing-tip, first section bristly, equal to third and two-thirds as long as second; distance between crossveins two times outer crossvein and slightly shorter than basal section of third vein; last section of second vein equal to two and one-half times basal section of third vein; last section of third vein distinctly curved up and ending before wing-tip; fourth vein faintly traceable from outer crossvein to wing-margin; fifth vein but faintly produced for a short distance beyond discal cell. Abdomen short, only one-half as long as thorax; second segment almost as long as the next two; margins of segments hairy. Halteres white. Length: 2 mm.

Type. Male, Nelson, B. C., July 17, 1910. A. L. Melander, Collector.

Paratypes. Twenty-five specimens from the following localities: Washington: Kettle Falls, Olympia (Melander). Idaho: Priest Lake (Melander). California: Monterey County. Texas: Austin (Melander). Illinois: (Ill. Univ.).

Leptocera (Collinella) **frosti** Johnson (Fig. 2).

Johnson: Psyche, XXII, 21 (1915). (*Limosina*).

Described from a single female specimen from Framingham, Massachusetts. Two specimens from Lexington and Beverly, Massachusetts.

Leptocera (Collinella) **schildi,** n. sp. (Fig. 9).

Opaque black. Front broader than high, almost uniformly grayish pubescent; interfrontal bristles in four pairs, the anterior two pairs long and cruciate; orbital setulæ minute, not extending above the upper fronto-orbital bristle; face tuberculate, vertically sinuose in profile; antennæ divergent, second joint margined with stiff bristles, third joint broader than long; arista almost three times antennal length with long pubescence; cheeks one-fifth as high as eye when measured at vibrissal angle. Mesonotum convex; dorsocentral bristles strong, in four pairs; posthumerals present; acrostichal hairs not developed, bristle-like; scutellum large, triangular, marginal bristles eight, the basal and third pair smaller than the others, the third pair encroaching upon the disc. Legs distinctly bristly, preapical bristle present; hind metatarsi two-thirds as long as second joint. Second segment of abdomen almost two times as long as third. Halteres white. Wings as in Fig. 9. Length 3 mm.

Type. Male; Costa Rica (Pablo Schild), Melander collection.

Allotype. Costa Rica (Pablo Schild).

Leptocera (Collinella) **fusinervis** Mall.

Malloch: Sm. Misc. Coll. 59, No. 17 pub. 2133, 6 (1912). (*Limosina*).

Malloch described this species from Panama.

Leptocera (Collinella) **limosa** Villeneuve Duda, (? Fallen) (Fig. 8).

Fallen: Dipt. Suec. Heterom. 8, pp. (1820). (*Limosina*).
Villeneuve: Deutsche Ent. Zeitschr. III, (1914). (*Limosina*).
Duda: Abhand. Zool.-Botan. Ges. Wien, X, 1, 59, (1918). (*Limosina*).

This species seems to have a wide distribution. More than one hundred and fifty specimens from the following localities: Washington: Pullman, Seattle, Friday Harbor, Bellingham, Olga, Omak, Tacoma, Puyallup, Quilcene, Dungeness, Sequim, Woodland, Spokane, Mt. Constitution, Prosser, Ephrata, Glenwood, Tulalip, Blynn (Melander). Idaho: Collins, Moscow, Chatcolet, Lake Waha, Potlatch (Melander). California: Berkeley Hills, Alameda, Milbrae, Mesa Grande (Cresson); Berkeley, Stanford (Melander); Palo Alto (Doane). Montana: Three Forks, Townsend (Melander). New Mexico: Alamogordo

(Cresson). Wyoming: Yellowstone Park (Melander). Arizona: Tucson, Ft. Yuma (Hubbard). Illinois: (Ill. Univ.). Ohio: Kent, Wauseon (Hine). Pennsylvania: Swarthmore (Cresson).

Leptocera (Collinella) **marginalis** Malloch.
Malloch: Tran. Am. Ent. Soc. 40, 22, (1914).

Costa Rica.

Leptocera (Collinella) **trochanteratus** Mall. (Fig. 13).
Malloch: Proc. U. S. N. M. 44, 462, (1913).

Nineteen specimens from the following localities: Illinois: Chicago (Melander). Pennsylvania: Jack Run, Allegheny, Lansdale (Cresson). Maryland: (Coquillett) Hancock. District of Columbia.

Leptocera (Collinella) **lutosa** Stenhammar. (Fig. 1).
Stenhammar: Coprom. Scand. 380. (122.) (1885.) (*Limosina.*)
Duda: Abhand. Zool-Botan. Ges. X, I, 51, (1918).
limosa Fallen: Dipt. Suec. Heterom. 8, Part, (1820). (*Limosina*).
riparia Robineau-Desvoidy: Myod. 802, 1 (1830). (*Nerea*).

This is the most common of all the species of *Collinella*. Collections from all parts of the North American continent produce it in great numbers. The combination of large size, tuberculate face, very strong bristles and rounded angle of the discal cell easily separates this species from all others in this genus. Four hundred and sixty-seven specimens from the following localities:

Washington: Husum, Tacoma, Granite Falls, Glenwood, Lilliwaup, Lake Washington, Index, Olympia, Mt. Constitution, Bellingham, Lake Whatcom, Mt. Rainier, Prosser, Almota, Ilwaco, Tulalip, (Melander). Idaho: Moscow (Aldrich); Potlatch, Priest Lake, Sandpoint (Melander). California: Stanford U. (Aldrich); Mesa Grande, Berkeley Hills, Alameda, Redwood Canon, Milbrae, Lagunitas Pass (Cresson); Eureka (Barber); Palo Alto (Doane). British Columbia: Clayton, Vancouver (Melander). Montana: Three Forks (Melander). Texas: Austin, Granite Mt. (Bishopp); Jacksonville (Johnson). Arizona: Flagstaff (Barber); Tucson (U. S. N. M.); Ft. Yuma (Hubbard). Illinois: (Ill. Univ.). Wisconsin: Divide (Johnson). Mexico: Mexico City (Barrett). Wyoming: Yellowstone Park (Melander). Florida: (Coquillett). New Hampshire: Franconia (Mrs. Slosson). Massachusetts: Boston (Melander); Beverly (Burgess). Pennsylvania: Swarthmore (Cresson); Montgomery Co. (Johnson).

Leptocera (Collinella) **brevista** Malloch.

Malloch: Tran. Am. Ent. Soc. 40, 23, (1914).

Described from Costa Rica.

Leptocera (Collinella) **atra** Adams (Fig. 5).

Adams: Kansas Univ. Sc. Bull. II, (1903). (*Limosina*).
setigera Adams: Kansas Univ. Sc. Bull. II, (1903). (*Limosina*).

Vertex opaque with five shining setæ; front slightly shining, with the narrow divergent stripes opaque; lower front reddish; inter-frontal bristles in four pairs, the anterior three pairs long and cruciate; anterior portion of face and cheeks brownish; eyes large; cheeks narrow at vibrissal angle, one-fourth as high as eye; buccal bristles strong; arlita short, two times antennal length with rather long pubescence. Mesonotum with four pairs of dorsocentral bristles; posthumeral bristles strong, incurved; scutellum large, triangular; disc bare; margin with eight bristles, the basal pair very weak; pleuræ opaque, sutures reddish; upper sternopleuræ with two bristles, the posterior one very long. Wings hyaline, veins brown; outer angle of discal cell short appendiculate; costa ending a little beyond third vein, third section three-fifths as long as second; penultimate sections of third and fourth veins nearly equal and a little less than two times outer crossvein; third vein curved up, ending before wing-tip. Abdomen short; dorsum flattened, broad; venter hairy; second segment nearly two times as long as third. Legs bristly, middle tibiæ with nine extensor and two flexor bristles; hind metatarsi a little thickened, two-thirds as long as next joint.

This species can be separated from *lutosa* Stenh. by its smaller size, by the reduced bristles of the legs, especially the hind tibiæ, by the reduction in number of interfrontal bristles, by the black halteres and by the appendiculate outer angle of the discal cell; from *limosa* Fall. by the greater number of bristles on the scutellum.

This species has a wide distribution. One hundred and fifty specimens from the following localities have been examined:

Washington: Oroville, Tacoma, Prosser, Palouse, Mt. Constitution, Almota, Kamiac Butte, Friday Harbor, Dewatto, Ephrata, Nooksack, Bellingham, Seattle, Lake Whatcom, Pateros, Lake Chelan (Melander). Idaho: Moscow (Melander-Aldrich); Potlatch (Melander). California: Stanford (Melander-Aldrich); Alameda (Cresson); Redwood Canyon, Berkeley Hills, (Cresson-Aldrich); San Mateo Co. (Baker); San Diego (Dyar-Caudell). Montana: Parma, Saltese (Melander). Colorado: Cold Springs (Tucker). Wyoming: Yellowstone Park (Melander); Sheridan (Metz). Utah: Salt Lake (Barber).

Arizona: Ft. Grant (Hubbard). New Mexico: Alamogordo, Highrolls (Cresson); Pecos (Cockerell). Kansas: McPherson (Knaus). Illinois: (Ill. Univ.). Texas: Austin (Melander); Victoria (Hine). Maryland: (Coquillett); Plummers Isl. (Currie). Massachusetts: Beverly (Burgess); Horse Neck Beach (Hough); Woods Hole (Melander). New York: Cold Spring Harbor, Oak Isl. (Melander). District of Columbia: (Coquillett).

The synonymy of *setigera* and *atra* is based on an examination of type material.

Leptocera (Collinella) **M-nigrum.** Malloch.

Malloch: Smiths. Misc. Coll. 59, No. 17, pub. 2133, 7 (1912). (*Limosina*).

I have thirteen specimens of a species from Jamaica, which agree quite well with Malloch's description of *L. M-nigrum*, from Panama. The specimens which I have, have been preserved in alcohol, consequently color characters have been lost. In the chaetotaxy and wing venation they agree with *L. M-nigrum*, and probably belong with this species.

Leptocera (Collinella) **subpiligera** Malloch.

Malloch: Ent. News, p. 176 (1914). (*Limosina*).

Described from Pennsylvania.

Species of Leptocera.

1. Opaque-cinereous black; antennæ, face and cheeks black; scutellum margined with red; outer tibial bristles strong; first section costa longer than third, bristly; third vein distinctly curved up on last section and ending before wing-tip; legs dark brown (2.5–3 mm.)....**dolorosa** Will.
   Antennæ, face and cheeks reddish; thorax dark yellowish red, opaque; mesonotum with abundant and rather long black hairs; middle and hind tibiæ with stout bristles on outer side; length, 2.5 mm....**illota** Will.
   Species of a different structure....2
2. Third vein perceptibly bowed up on its last section; scutellum with six to eight marginal bristles....3
   Third vein but little curved up, ending at wing-tip or nearly so; scutellum with six marginal bristles, the basal pair very weak; posthumeral bristles present, incurved; middle femora with a stiff upright bristle at apex on inner surface. Figs. 11....**hoplites,** n. sp.
3. Wings short and blunt; second section of costa two times as long as third; front, face, cheeks and antennæ yellow; mesonotum yellowish brown with three distinct pairs of dorsocentral bristles; hypopygium yellow, not large; legs yellow; scutellum with six to eight marginal bristles; disc opaque black; halteres pale yellow. (1.25–2 mm.)....**fulva** Mall.
   Wings normally long; second and third sections of costa more nearly equal...4
4. Front, face, cheeks, antennæ and legs reddish or yellowish; notum reddish brown; scutellum velvety black; middle trochanter with long bristles, other bristles of legs considerably reduced. Figs. 12....**discalis** Mall.
   Face and cheeks cinereo-opaque; bristles or legs numerous and stronger; legs darker; bristles of head and notum prominent; acrostichal bristles well developed; arista three times antennal length; middle tibiæ with a reduced apical bristle on extensor surface. Fig. 6....**fontinalis** Fall.

Leptocera (Leptocera) **dolorosa** Williston.
Williston: Tran. Ent. Soc. Lond., 1896, 432, (*Limosina*).

Described from St. Vincent, W. I.

Leptocera (Leptocera) **illota** Williston.
Williston: Tran. Ent. Soc. Lond., 434, (1896). (*Borborus*).

St. Vincent, W. I.

Leptocera (Leptocera) **hoplites,** n. sp. (Fig. 11).

Black subshining; front convex, almost two times as broad as long, gray pollinose, except the narrow stripes between the frontal triangle and the interfrontal stripes; bristles of head strong; fronto-orbital bristles slightly divergent, the upper much longer than the other, directed backward as well as outward over eye; orbital setulæ distinct, the upper two pairs much longer; interfrontal bristles in three pairs, the upper weak, the middle reaching the median line and the anterior pair very long and cruciate; interfrontal setulæ in two pairs, situated laterally to interfrontal stripes; face and cheeks gray pollinose; cheek, at narrowest point, one-third as high as eye; oral vibrissæ long; oral setulæ prominent, the anterior pair bristle-like; buccal setulæ bristle-like, in two pairs, curved up; face slightly concave in profile, carina developed between the antennæ only, epistome slightly curved up at lower margin, clypeus narrowly visible from above; antennæ divergent; third joint oval, two-thirds as long as broad; arista two and one-half times antennal length, with short dense pubescence. Mesonotum broad, convex; dorsocentral bristles in four pairs, increasing in size posteriorly; acrostichal bristles in eight rows, the middle two longer than the others; scutellum large, triangular, margined with four very long bristles and two setæ at base; pleuræ sutures fuscotestaceous, sternopleuræ with two bristles, the anterior smaller than the other. Legs bristly; femora piceous; coxa, trochanter, tibiæ and tarsi fuscotestaceous, middle trochanter with a small bristle, middle femora with a row of nine setæ on the anterior side, the apical one bristle-like; middle tibiæ with two flexor bristles, one near apex, and five strong extensor bristles, two on the basal third and three on the apical third; first joint middle tarsi with a strong bristle beneath, and a number of bristles on apex; hind metatarsi one-half as long as second joint. Wings slightly browned; veins piceous; costa ending at third vein, first section bristly, equal to third and three-fourths as long as second, basal section of third vein two-fifths as long as second section of fourth vein, one and one-half times outer crossvein; last section of third vein slightly curved up and ending a little before wing-tip; last section of fourth vein not traceable to wing-margin. Abdomen short, about two-thirds as long as thorax; second section one and one-fourth times as long as third. Halteres yellow. Length 1.5–2 mm.

Type. Male; Washougal, Wash. (Melander). *Paratypes.* Sixteen specimens from the following localities:

Washington: Lake Whatcom, Pullman, Mt. Constitution, Kamiac Butte (Melander). Oregon: Viento, Hood River (Melander). Vermont: Lynden (Melander).

Leptocera (Leptocera) **fulva** Malloch.

Malloch: Smithsonian Misc. Coll., 59, 17, publ. 433, 4 (1912). (*Limosina*).

Panama.

Leptocera (Leptocera) **discalis** Malloch. (Fig. 12.)

Malloch: Smiths. Misc. Coll. 59, No. 17, pub. 433, 8, (1912). (*Limosina*).
scutellaris Williston: Tran. Ent. Soc. Lond., 432, (1896). (*Limosina*).

Six specimens from Granada, W. I. (Aldrich) and Costa Rica (Schild).

Leptocera (Leptocera) **fontinalis** Fallen*. (Fig. 6.)

Fallen: Dipt. Suec. Suppl. 2, 16, (1826). (*Limosina*).
Duda: Abhand. Zool.-Botan. Ges. Wien. X 1, 70, (1918).
arcuata Macquart: Suite à Buff. II. 572, (1835). (*Limosina*).

This species is rather common and has a wide distribution. One hundred and eight specimens from the following localities: Washington: Lake Crescent, Everett, Quilcene, Woodland, Blaine, Pullman (Melander). Idaho: Troy (Cresson); Priest Lake (Melander). British Columbia: Langley, Clayton (Melander). Oregon: Salem (Melander). California: Berkeley Hills, Redwood Canyon (Cresson). New Mexico: Highrolls (Cresson). Texas: Dallas (Cresson); Austin (Melander). Kansas: Argus Mts. (U. S. N. M.); Lawrence (Aldrich). Missouri: St. Louis (Warner). Illinois: (Ill. Univ.); Chicago (Melander). Mississippi: (U. S. N. M.). Louisiana: (U. S. N. M.). Virginia: Rosslyn (Townsend). Massachusetts: Lexington (Riley); Lawrence (King); Woods Hole (Melander). Pennsylvania: Swarthmore (Cresson),

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EXPLANATION OF PLATE XVIII.

Fig. 1. *Collinella lutosa* Stenh.
Fig. 2. *Collinella frosti* Johnson.
Fig. 3. *Collinella echinaspis*, n. sp.
Fig. 4. *Collinella trigonata*, n. sp.
Fig. 5. *Collinella atra* Adams.
Fig. 6. *Leptocera fontinalis* Fall.
Fig. 7. *Collinella fumipennis*, n. sp.
Fig. 8. *Collinella limosa* Villen.—Duda.
Fig. 9. *Collinella schildi*, n. sp.
Fig. 10. *Collinella fuscipennis* Hal.
Fig. 11. *Leptocera hoplites*, n. sp.
Fig. 12. *Leptocera discalis* Mall.
Fig. 13. *Collinella trochanteratus* Mall.

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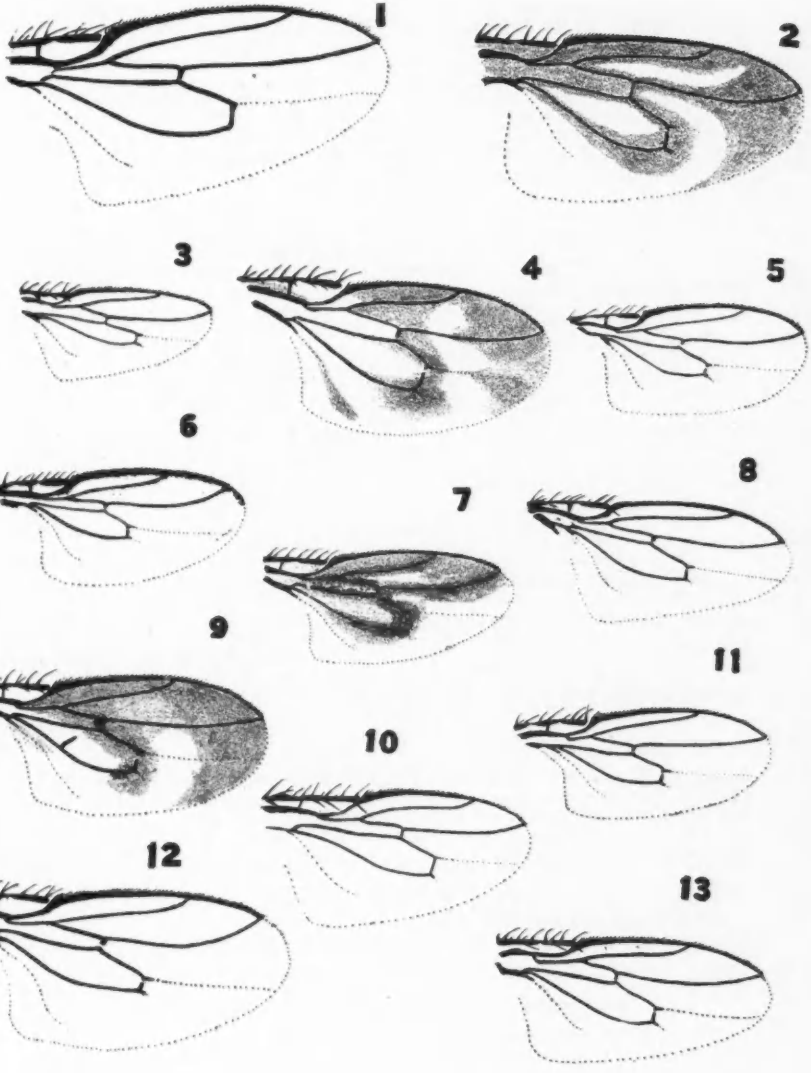
* Together with this species are a number of flies that have the acrostichal bristles reduced and are considerably smaller. They are not *roralis* Rond., since they lack the distinct apical bristle on extensor surface of middle tibiæ so common with *roralis*. Since this species differs from *fontinalis* in relative characters only, the writer has placed them with *fontinalis*.



Anthony Spuler

THE ENTOMOLOGICAL SOCIETY OF AMERICA.

PROCEEDINGS OF THE CINCINNATI MEETING.

First Session, Thursday Afternoon, December 27, 1923.

The Society was called to order at 1:40 P. M. by the President, Prof. T. D. A. Cockerell, in Room 18, Hanna Hall Annex, University of Cincinnati. The attendance at this session ranged from 45 to 95. The following papers were presented:

1. The Relation of Insects to Polluted Streams. (15 min.) (Lantern). P. W. CLAASSEN, Cornell University.
2. Some Comparative Studies in Poisonous Lepidopterous Larvæ. (15 min.) (Lantern). PAUL M. GILMER, Minnesota Agricultural Experiment Station.
3. The Effect of the Venom of Some Supposedly Poisonous Arthropods. (10 min.) (Lantern). W. J. BAERG, University of Arkansas.
4. The Composition of "Vein 8" of Systematists in the Hind Wings of Some Microlepidoptera. (15 min.) ANNETTE F. BRAUN, Cincinnati, Ohio.
5. Histology of the Eye in Acalyptrate Muscidæ. (By title). O. A. JOHANNSEN, Cornell University.
6. A Grasshopper Specimen with Two Median Ocelli. (10 min.) (Lantern). R. D. GLASGOW, University of Illinois.
7. The so-called Occipital Suture in the Trichopterous Larvæ and in Other Orders. (By title). JOSEPH KRAFKA, JR., University of Georgia.
8. The Cephalization of the Head in Insects. (15 min.) (Lantern). ALEX. D. MACGILLIVRAY, University of Illinois.
9. The Homopterous Head. (By title). Z. P. METCALF, North Carolina State College.
10. Some Aquatic Hemiptera having only four Nymphal Stages. (5 min.) WILLIAM E. HOFFMAN, University of Minnesota.
11. A Plan for Financing the Proposed General Catalogue of the Hemiptera. (15 min.) H. M. PARSHLEY, Smith College.

President Cockerell then appointed the following Committees:

Nominating Committee—PAUL S. WELCH, H. M. PARSHLEY, W. T. M. FORBES.
Auditing Committee—W. E. BRITTON, A. D. MACGILLIVRAY, ANNETTE F. BRAUN.
Resolutions Committee—J. G. NEEDHAM, E. D. BALL, J. J. DAVIS.

Second Session, Friday, Morning, December 28, 1923.

The Society was called to order at 10:00 A. M. by the President, Prof. Cockerell, in Room 18, Hanna Hall Annex. The reports of the Executive Committee and the Secretary-Treasurer were made as follows:

REPORT OF THE EXECUTIVE COMMITTEE.

So far as the activities of the Executive Committee and the Secretary's office are concerned, the past year may be characterized as one of conservative progress. While there have been no outstanding developments, there is every indication of a loyal, enthusiastic and satisfied membership.

The Secretary has instituted one new feature that promises greatly to strengthen the Society. Based largely on the interest certain members have shown in recent years, he has designated one, or sometimes two, such members in each state to act as a kind of "State Agent" for the Society. Each State Agent is supplied with the list of members credited on our records to that state, and has been asked to take the lead in increasing membership from his state. These Agents should also be very useful to the Society in keeping record of members who move from place to place; and there are doubtless other ways in which they will find it possible to serve the Society.

As directed by the Executive Committee at the Boston meeting, the revised list of the fellows and members was published in the June number of the ANNALS. A new feature of this list, which it is believed will be welcomed by members, is an indication of the taxonomic groups and other phases of entomology in which various members are especially interested, and whether or not they are willing to make determinations in certain groups. This data was derived from the members' "Information Cards" in the Secretary's files. The list can probably be made much more complete and useful for subsequent printing if other members will supply similar data.

In October the Executive Committee invited Doctor James G. Needham, of Cornell University, to deliver the Annual Public Address at the Cincinnati meeting. Certain members of the Committee have rendered important help to the Secretary in arranging for the present meeting, especially for the Symposium.

On June 6, 1923, the following members were elected by mail ballot of the Executive Committee.

(NOTE: This list and the one below should be added to the list of members in the June ANNALS to make the membership list complete to date).

KENNETH M. KING, University of Saskatchewan, Saskatoon, Canada.
HOWARD L. SEAMAN, Canadian Department of Agriculture, Lethridge, Alberta.
ALFREDO FAZ, Bandera No. 714, Santiago, Chile, South America.
ABRAHAM MONTEALEGRE RANDOLPH, Cassila 1, Valdivia, Chile, South America.
WILLIAM DOYLE REED, Instructor in Entomology and Zoology, Clemson College, South Carolina.
WILFRED WEDGWOOD BOWEN, Wellcome Tropical Laboratories, Khartoum, Sudan.
JERAULD A. MANTER, Connecticut Agricultural College, Storrs, Connecticut.
MORRIS ALBION STEWART, Tri Gamma House, Durham, New Hampshire.
PAUL HERBST, Casilla 3528, Valparaiso, Chile, South America.
DR. JUAN BRETHES, Mar Chiquita 5033, General Urquiza (F. C. C. A.), Buenos Aires, Republic of Argentina.
CARLOS MOREIRA, Rua Sta. Clara 26, Copacabana, Rio de Janeiro, Brazil.

(Total, 11).

The Executive Committee met at 4:30, December 27, 1923, in Room 18, Hanna Hall Annex, University of Cincinnati, with the following members present: T. D. A. Cockerell, Wm. S. Marshall, C. L. Metcalf, Herbert Osborn, W. A. Riley, and R. A. Cooley.

The following persons, having been duly nominated and recommended, were elected members of the Society:

THOMAS ARMSTRONG, MacDonald College P. O., Quebec Province, Canada.
ALEXANDER. D. BAKER, MacDonald College P. O., Quebec Province, Canada.
CLARENCE OWEN BARE, 641 Missouri Street, Lawrence, Kansas.
D. MARSTON BATES, Ft. Lauderdale, Florida.
CURTIS BENTON, University of Illinois, Urbana, Illinois.
MR. L. J. BOTTIMER, Box 51, Liberty, Texas.
HARRY R. BRYSON, 1201 Bluemont Street, Manhattan, Kansas.
HIRAM G. BURT, 1321 Poyntz Avenue, Manhattan, Kansas.
CARLOS CAMACHO, Casilla 1248, Santiago de Chile, South America.
S. W. CLARK, East Lansing, Michigan.
Wm. J. CLENCH, Museum Bldg., Ann Arbor, Michigan.
J. R. DOUGLAS, P. O. Box 353, Estancia, New Mexico.
CARL D. DUNCAN, Box 4, Stanford University, California.

CLIFFORD O. EDDY, Clemson College, South Carolina.
A. JOHN FLEBUT, Lindsay, California.
STANLEY B. FREEBORN, Massachusetts Agricultural College, Amherst, Mass.
LULA G. FRITZ, 1183 Grand Avenue, Topeka, Kansas.
CHARLES L. FLUKE, 1532 University Avenue, Madison, Wisconsin.
C. L. FRANKENFIELD, Box 86, Keego Harbor, Michigan.
CHAS. H. HADLEY, Bureau of Plant Industry, Harrisburg, Pennsylvania.
H. M. HARRIS, Iowa State College, Ames, Iowa.
GEO. H. HAMMOND, Aylmer, Quebec, Canada.
F. C. HOTTES, Iowa State College, Ames, Iowa.
THEO. H. HUBBELL, University of Florida, Gainesville, Florida.
E. G. KELLY, Agricultural College, Manhatton, Kans.
JOSEPH W. KRAFKA, JR., University of Georgia, Athens, Georgia.
SATORU KUWAYAMA, Hokkaido Agricultural Experiment Station, Sapporo, Japan.
JOE L. E. LAUNDERDALE, Box 158, Leland, Mississippi.
ADOLPHUS LUTZ, Cairea Postal 926, Rio de Janeiro, Brazil.
J. EDWARD MCEVILLY, Box 363, McComb, Mississippi.
ADONIS A. MATHEWSON, Zoology Dept., Columbus, Ohio.
W. B. MABEE, North Carolina State Department of Agriculture, Raleigh, N. C.
GEO. B. MERRILL, Gainesville, Florida, State Plant Board.
JOHN C. PALLISTER, 2717 Euclid Avenue, Cleveland, Ohio.
NELLIE M. PAYNE, University Farm, St. Paul, Minnesota.
O. WALLACE PARK, 714 Indiana Avenue, Urbana, Illinois.
BENNET. A. PORTER, 10 W. Sycamore Street, Vincennes, Indiana.
PHILIP A. READIO, 1409 Tennessee Street, Lawrence, Kansas.
LESLIE ROGERS, Agricultural Experiment Station, New Haven, Connecticut.
JOSEPH A. REEVES, 94 West Oakland Avenue, Columbus, Ohio.
W. A. RUFFIN, Iowa State College, Ames, Iowa.
KENNETH A. SALMAN, Glenwood Road, Needham, Massachusetts.
ROBERT L. SHOTWELL, Box 1094, Billings, Montana.
J. C. SILVER, 17 E. Highland Avenue, Melrose Highlands, Massachusetts.
BRANDT F. STEELE, 811 East Drive, Woodruff Place, Indianapolis, Indiana.
HARVEY L. SWEETMAN, Iowa State College, Ames, Iowa.
ARCHIE N. TISSOT, 1902 N. High Street, Columbus, Ohio.
J. ALBERT VELLARD, F8 rua Parcira Nunes, Nictheroy (Est. IoRio), Brazil.
HUGH E. WALLACE, Division of Entomology, University Farm, St. Paul, Minn.
FRED W. WALKER, University of Florida, Gainsville, Florida.
ARTHUR B. WELLS, Bryn Athyn, Pennsylvania.
CECIL CLINE WILSON, 820 Moro Street, Manhattan, Kansas.
WARREN J. WILLIS, 2221 Thirty-fifth Place, N. W., Washington, D. C.

(Total, 53).

The above lists include eight prominent South American Entomologists, who have joined the Society in response to the special invitation authorized by the Society at the Toronto meeting.

Edgar L. Dickerson, a charter member of the Society, died on October 30, 1923.

The following resignations of members were presented and by action of the Executive Committee these resignations were accepted and the memberships are hereby terminated:

G. C. BECKER	B. PICKMAN MANN	R. R. ROWLEY
MRS. WILBURT A. CLEMENS	JOHN C. PEARSON	FRANCIS J. A. MORRIS
EUGENE M. CRAIGHEAD	MORGAN HEBARD	PAUL DOGNIN

(Total, 9).

Thirty-four members whose dues are in arrears for more than two years and who have been duly notified of the fact, were by vote of the Executive Committee, dropped from membership.

Total loss of membership for year..... 44
Membership reported 1922. (See Annals XVI, p. 88).....653
Balance.....609
New members elected during 1923..... 64
Total present membership.....673

It appears at this date that the transition from a $2.00 to a $3.00 annual dues will be made without any serious loss in membership. While our loss in membership for the year is larger than usual, most of those who have withdrawn on account of the increase in dues were in arrears, or lukewarm in the activities of the Society. Our Society will not be greatly weakened by these losses and the increased revenue should make possible a considerably enlarged journal. On December 10th, when the Secretary ceased recording payments of annual dues, the Society was in the following condition with respect to the payment of dues. The comparison with the two preceding years is shown.

	1923	1922	1921
Members and Fellows paid 3 years in advance	0	0	1
Members and Fellows paid 2 years in advance	0	2	3
Members and Fellows paid 1 year in advance	194	179	222
Members and Fellows paid for year just ending	332	327	219
Members and Fellows 1 year in arrears	47	28	62
Members and Fellows 2 years in arrears	15	22	18
Members and Fellows 3 years in arrears	0	1	16
Life Members	15	15	13
Honorary Fellows	5	5	5
New Members not yet paid	64	74	47
Totals	672	653	606

The Executive Committee recommends to the Society that a grant of $50.00 from the Treasury, together with two anonymous contributions of $10.00 be made to the Imperial Bureau of Entomology for the support of the Zoological Record.

The Executive Committee further recommends that the Committee on Nomenclature be discontinued.

The Executive Committee reports that the following persons have been elected as members of the Thomas Say Foundation:

J. Chester Bradley, to succeed Wm. T. Davis, and Arthur Gibson, to succeed himself. These terms to expire December 31, 1925.

The following persons were elected to the Editorial Board of the Annals: Wm. Schaus, E. C. Van Dyke, W. E. Britton, to succeed F. E. Lutz, W. E. Marshall, and V. L. Kellogg. These terms expire December 31, 1926.

Respectfully submitted,

C. L. METCALF, *Secretary.*

On motion this report was accepted and the recommendations contained therein adopted.

The report of the Treasurer was presented as follows:

REPORT OF THE TREASURER.

CURRENT FUNDS.

RECEIPTS.

Balance, Dec. 21, 1922 (See Annals, Vol. XVI, No. 1, p. 90)	$ 913.09
From Annual Dues of Members	1,358.40
From Managing Editor of the Annals	469.22
From Interest on Bonds	29.71
From Interest on Current Account	15.00
From Sale of 9 War Savings Stamps (Called)	45.00
Gained by Exchange	.37
Checks refused by banks (to balance)	12.00
Total	$2,842.79

EXPENDITURES.

Annals for June, 1922, (XV, 2), including reprints	$ 289.75
Annals for September, 1922, (XV, 3), including reprints	282.25
Annals for December, 1922, (XV, 4), including reprints	322.75
Annals for March, 1923, (XVI, 1), including reprints	317.20
Postage and Envelopes for Annals	40.83
Stamps and Stamped Paper, Secretary's Office	30.30
Clerical and Stenographic Assistance	152.41
Printing and Stationery	132.91
Office Supplies	3.91
Telegrams	2.80
Safety Deposit Box	1.80
Lost by exchange on check	.15
Checks refused by bank (to balance)	12.00
Canadian Bond purchased	50.62
Refund to C. R. Neillie	1.00
Total	$1,640.68
Balance, cash on hand, First National Bank, Champaign, Illinois, December, 1923	1,202.11
	$2,842.79

Of this amount, $200 belongs to our permanent fund, leaving an amount available to meet our obligations of $1,002.11.

LIABILITIES.

The Society owes the publishers of the Annals for the June, September, and December, 1923, numbers of the Annals, (Volume XVI, Nos. 2, 3, and 4), being in this respect exactly equal to our status last year, one issue ahead of our status in 1922, and two issues ahead of our status in 1921.

CONDITION OF PERMANENT FUNDS.

On hand, latest report (Annals, Vol. XVI, No. 1, p. 91)	$944.00
Drawn from Current Account to purchase Canadian Bond	6.00
Total	$950.00

SECURITIES HELD.

(Liberty Bonds estimated at their face value).

First Liberty Loan Bond No. B00911757	$ 50.00
Second Liberty Loan Bond No. B02787752	50.00
Third Liberty Loan Bond No. 5876278	50.00
Third Liberty Loan Bond No. 5876279	50.00
Third Liberty Loan Bond No. 5876280	50.00
Third Liberty Loan Bond No. 4203250	100.00
Third Liberty Loan Bond No. 4203251	100.00
Fourth Liberty Loan Bond No. H05321828	100.00
Fourth Liberty Loan Bond No. C04921513	50.00
Fourth Liberty Loan Bond No. D04921514	50.00
Fourth Liberty Loan Bond No. E04921515	50.00
Dominion of Canada 15 yr. 5½ Gold Bond, Series T, No. H048969	50.00
Total Face Value of Securities	$750.00
Balance carried in current account	200.00

Nine War Savings Stamps have been called and cashed for face value, $45.00.

Respectfully submitted,

C. L. METCALF, *Treasurer.*

Upon motion this report of the Treasurer was accepted and the financial matters involved referred to the Auditing Committee.

The next item of business was the report of the Managing Editor of the ANNALS:

REPORT OF THE MANAGING EDITOR.

There has been, I believe, some improvement in the publication situation during the present year, and the volume of Annals will, I believe, compare fairly well with those of preceding years and a number of creditable papers are in hand for the coming volume. The receipts of the office have totaled:

Subscription account	$382.78
Sale of back volumes and numbers	133.48
Reprints and contributions	319.57
Total	$835.83

EXPENDITURES

Stenographic and clerical help	$ 62.06
Postage, etc	42.91
Engraving	261.64
Balance to Treasurer	469.22
Total	$835.83

Subscriptions from Foreign Libraries have increased somewhat, but comparatively few full sets have been sold during the year. Orders in hand will help to increase this income for the coming year. With the increase of the price of the journal we will secure a somewhat larger income from subscriptions and it may be desirable to advance the price of the back volumes still available for sale. Dr. Kennedy's efficient assistance is gratefully acknowledged and the kind co-operation of members of the editorial board and others in securing desirable papers and of institutions that have assisted in financing some of the publications is thankfully recorded.

Respectfully submitted,

HERBERT OSBORN, *Managing Editor.*

On motion this report was accepted and the financial matters involved referred to the Auditing Committee.

The next report was that of the Editor of the Thomas Say Foundation.

REPORT OF THE EDITOR OF THE THOMAS SAY FOUNDATION.

The funds of the Thomas Say Foundation accumulated so slowly from the sale of the first volume, that the publication of a second was not considered until recently. Somewhat more than a year ago, however, it began to seem that we could finance a second volume, and a suitable manuscript was sought.

In this quest we have had much more difficulty than anticipated. It appears that the poor prospect of publication is at present deterring most entomologists in North America from undertaking large works.

The Foundation, after giving serious consideration to three different manuscripts, which for various reasons we thought we could not publish, has finally received for its action a manuscript, unfortunately not yet quite completed, which we hope to accept in a short time. Its authorship is of unquestioned authority; it is provided with abundant illustrations of high quality; it deals in a fundamental way with a much neglected but common group, with especial attention to immature stages—and in all respects it gives promise of becoming a classic. It will make a much larger volume than our first. Until we have taken definite action we prefer not to mention the title of the work. If all goes as anticipated, we can probably make an announcement in the March Annals.

Respectfully submitted,

J. M. ALDRICH, *Editor, Thomas Say Foundation.*

In a discussion of this report it was announced by the Committee that this second memoir on North American Entomology will probably appear at an early date.

The next report was that of the Treasurer of the Thomas Say Foundation:

REPORT OF THE TREASURER OF THE THOMAS SAY FOUNDATION.

EXPENDITURES FOR 1923.

Postage on 14 copies	$ 1.59
Cash on hand to balance	362.69
Total	$364.28

RECEIPTS FOR 1923.

Balance on hand January 1, 1923	$314.32
Seven Subscribers at $3.00	21.00
One Subscriber at $2.71	2.71
Six Subscribers at $2.25	13.50
Interest	12.75
Total	$364.28
Balance on hand January 1, 1924	$362.69

There are outstanding obligations to the original subscribers of $260.00, leaving a net balance of $102.69 to the credit of Volume I if the original grant of the Society of $50.00 is neglected, or $52.69 if it is considered.

Respectfully submitted,

J. J. DAVIS, *Treasurer.*

On motion this report was accepted and referred to the Auditing Committee.

The next item of business was the report of the Committee on Entomology in the National Museum:

REPORT OF THE COMMITTEE ON NATIONAL MUSEUM.

Your Committee has no very important matters to present at this meeting, as aside from conferences with the Museum Curators we have had little opportunity to discuss matters of importance with regard to the Museum collection. Several items, however, that are of general interest to the Society may be mentioned. Of special interest is the announcement that Dr. J. M. Aldrich's collection of Diptera has been given to the Museum, the details being reported in *Science* a few weeks ago.

Your Committee has endeavored to co-operate with the Museum in securing the deposit of type material in the National collection from various sources which were indicated as especially desirable. An item of special interest is that the Bureau of Plant Industry of the Pennsylvania Department of Agriculture has deposited a collection containing all of the types of insects previously in the custody of the Pennsylvania Department of Agriculture. Such instances should be a source of satisfaction to the members of the Society and an encouragement to others who have charge of the collections which would be of service there.

While it is of course important for specialists to retain type material while needed in their studies, it is to be hoped that it will become a general practice to provide for the deposition of as large an amount of material as possible in the National Museum, where it may be expected to have permanent preservation and accessibility to future workers.

Respectfully submitted,

CHAS. W. JOHNSON WM. M. WHEELER
HERBERT OSBORN JAS. G. NEEDHAM.

On motion this report was accepted.

On motion it was voted that this committee be continued and requested to report at the next annual meeting, making such recommendation as seem to it desirable regarding the scope and future work of this committee.

It was voted to continue the Committee on Election to Fellowship which was requested to make a more definite report to the Executive Committee at the next Annual Meeting. On motion it was voted that it is the sense of this meeting that the ten per-cent fellowship limit be considered merely suggestive and advisory.

The next item of business was the adoption of the proposed amendment to the constitution providing for the election of two representatives of the Society on the Council of the American Association for the Advancement of Science, by vote of the members, as a substitute for the ex-officio service of the president and the preceding past-president. By this action the constitution is amended to read as follows:

ARTICLE IV, SECTION III. *Councillors to the American Association.*—Two representatives on the Council of the American Association for the Advancement of Science shall be elected by ballot at the Annual Meeting for a term of one year, and shall be eligible for re-election. In case of the death, resignation, absence or inability to serve of either or both councillors, the vacancy shall be filled by the Executive Committee.

On request the report of the Committee on Resolutions was deferred until the Saturday morning session.

The report of the Auditing Committee was as follows:

REPORT OF THE AUDITING COMMITTEE.

We, the undersigned members of the Auditing Committee, have this day examined the accounts of C. L. Metcalf, Treasurer of the Entomological Society of America, for the year ending December 21, 1923; the accounts of Herbert Osborn, Managing Editor of the Annals, for the year ending December 15th, 1923; and the accounts of J. J. Davis, Treasurer of the Thomas Say Foundation, for the year ending December 31, 1923, and have found them to be correct.

(Signed) W. E. BRITTON,
A. D. MACGILLIVRAY,
ANNETTE F. BRAUN.

The report of the Nominating Committee was presented as follows:

REPORT OF THE NOMINATING COMMITTEE.

We, the undersigned members of the Committee on Nominations, beg leave to report the following names as nominees for the respective offices for the year 1924:

For President—C. W. JOHNSON.
For First Vice-President—W. E. BRITTON.
For Second Vice-President—C. T. BRUES.
For Secretary-Treasurer—C. L. METCALF.
For Additional Members of the Executive Committee—
HERBERT OSBORN, Managing Editor of the Annals, *ex-officio*.
T. D. A. COCKERELL, W. D. FUNKHOUSER, J. H. EMERTON.
ARTHUR GIBSON, EDITH M. PATCH,
For Councilors to the American Association for the Advancement of Science—
P. P. CALVERT, J. G. NEEDHAM.

(Signed) PAUL S. WELCH,
H. M. PARSHLEY,
WM. T. M. FORBES.

On motion the Secretary was instructed to cast the ballot for the unanimous election of these officers. This being done the officers were declared duly elected.

The business session was adjourned and the Society listened to the following papers of the Symposium:

METHODS OF PROTECTION AND DEFENSE AMONG INSECTS.

PART A. PROTECTIVE STRUCTURES.

An unusually hard bodywall; non-venemous bristles, spines or body-processes; urticating or nettling hairs; corrosive or vesicant fluids; repulsive odors; eversible glands.

12. Introductory Paper. (20 min.) CLARENCE H. KENNEDY, Ohio State University.
13. Protective Structures Among the Orthoptera. (5 min.) A. N. CAUDELL, U. S. National Museum.
14. Protective Structures of the Membracidæ. (5 min.) W. D. FUNKHOUSER, University of Kentucky.

The attendance at this session ranged from 65 to 125.

Third Session, Friday Afternoon, December 28, 1923.

The Society was called to order at 1:30 P. M. in Room 37, McMicken Hall and listened to the remaining papers of the Symposium:

15. The Unusually Hard Body-wall of Adult *Calendra*. (5 min.) A. F. SATTERTHWAIT, U. S. Bureau of Entomology.
16. Noteworthy Protective Structures among the Hymenoptera. (5 min.) S. A. ROHWER, U. S. Bureau of Entomology.
17. Protective Structures among the Ants. (5 min.) GEORGE C. WHEELER, Syracuse University.
18. Protective Structures of the Anteoninæ. (5 min.) F. A. FENTON, Iowa State College.
19. A Noteworthy Protective Structure of Lepidopterous Larvæ. (5 min.) W. T. M. FORBES, Cornell University.

PART B. PROTECTIVE CONSTRUCTIONS.

Webs, cocoons, cases, nests; barriers; excreta; exuviæ; secretions or excretions; elevating constructions.

20. Introductory Paper. (20 min.) W. V. BALDUF, University of Illinois.
21. Protective Constructions among the Cercopidæ. (5 min.) LOUIS A. STEARNS, Virginia State Crop Pest Commission.
22. Observations on the Protective Secretions of the Green Apple Aphid. (5 min.) FRANK H. LATHROP, New York State Agricultural Experiment Station.
23. The Cocoon of *Donacia*. (5 min.) ALEX. D. MACGILLIVRAY, University of Illinois.
24. Protective Constructions of the Chrysopidæ. (5 min.) ROGER C. SMITH, Kansas State Agricultural College.
25. The Barrier of the Lodge-pole Needle Miner. (By title). R. A. COOLEY, University of Montana.
26. Protective Constructions among Aquatic Lepidoptera. (5 min.) PAUL S. WELCH, University of Michigan.
27. Protective Constructions of Spiders. (By title). C. R. CROSBY, Cornell University.

PART C. PROTECTIVE SIZE, FORM AND COLOR.

Protective or aggressive resemblance and mimicry; warning coloration; grotesque or frightening appearance; extremes of size.

28. Introductory Paper. (20 min.) G. J. SPENCER, Ontario Agricultural College.
29. Protective Form and Color among the Cicadellidæ. (5 min.) D. M. DELONG, Ohio State University.
30. Protective Form and Color of Terrestrial Hemiptera. (5 min.) H. H. KNIGHT, University of Minnesota.
31. Protective Form and Color of Aquatic Hemiptera. (5 min.) J. R. DE LA TORRE BUENO, Brooklyn Entomological Society.
32. Protective Resemblance of Papilionid Pupæ. (5 min.) S. J. HUNTER, University of Kansas.
33. Protective Form and Color of the Nest of *Metapolybia*. (By title). J. CHESTER BRADLEY, Cornell University.

PART D. PROTECTIVE POSITIONS.

On protected surfaces of plants and animals; internally in plants and animals; in the soil, under leafmold, grass, trash, decaying organic matter; on or under water; in nests of other animals (without symbiosis).

35. Protective Positions of the Thysanoptera. (5 min.) J. R. WATSON, Florida Agricultural Experiment Station.
36. Secretiveness among the Coccidæ. (5 min.) J. S. HOUSER, Ohio Agricultural Experiment Station.
37. Unusual Shelters sought by Chinch Bugs from Heat and from Cold. (5 min.) W. P. FLINT, Illinois State Natural History Survey.
38. Protective Positions of Mallophaga and Anoplura. (By title). O. G. BABCOCK, U. S. Bureau of Entomology.
39. The Internal Position of the Boll Weevil and the "Revenge" of the Cotton Plant. (5 min.) W. E. HINDS, Alabama Polytechnic Institute.
40. The Concealment of *Sitona hispidula*. (5 min.) W. H. LARRIMER, U. S. Bureau of Entomology.
41. Protective Positions of Ants. (5 min.) MARION R. SMITH, Mississpipi Agricultural College.

PART E. PROTECTIVE BEHAVIOR OR REACTIONS.

Hiding; feigning death; running, jumping, flying, swimming or diving away; biting, stinging, fighting or threatening; guarding or transporting their own kind; symbiosis; extreme prolongation of certain life-stages; activity at pro ective times; unusual methods of reproduction; extreme fecundity.

42. Introductory Paper. (By title). W. C. ALLEE, University of Chicago.
43. A Case of Maternal Solicitude in Hemiptera. (By title). HARRY G. BARBER, Roselle, N. J.
44. Protective Behavior among Aquatic Hemiptera. (5 min.) H. B. HUNGERFORD, University of Kansas.
45. Protective Behavior of Aphiidæ. (By title). EDITH M. PATCH, Maine Agricultural Experiment Station.
46. Symbiosis of the Hog Louse. (5 min.) LAURA FLORENCE, Rockefeller Institute for Medical Research.
47. Protective Behavior among the Ipidæ. (By title). W. M. BLACKMAN, Syracuse University.
48. Protective Behavior among the Bremidæ. (5 min.) THEODORE H. FRISON, Illinois State Natural History Survey.
49. The Male *Trypoxylon* Guarding the Nest. (5 min.) PHIL RAU, St. Louis, Missouri.
50. Extreme Prolongation of Some Life-stages. (5 min.) W. D. HUNTER, Federal Horticultural Board.

51. More than Thirty Parthenogenetic Generations of a Hymenopterous Parasite. (By title). E. A. HARTLEY, Syracuse University.
52. Protective Behavior among the Acarina. (5 min.) PHILIP GARMAN, Connecticut Agricultural Experiment Station.

The attendance at this session was about 175.

Saturday Morning Session,

December 29, 1923.

The Society was called to order at 10:30 A. M. in Room 18, Hanna Hall Annex, with President Cockerell in the chair.

The deferred report of the Committee on Resolutions was presented as follows:

REPORT OF THE COMMITTEE ON RESOLUTIONS.

1. *Resolved,* That the Entomological Society of America extend to the Local Committee and to the University of Cincinnati, its sincere thanks for the careful provisions they have made for its comfort and convenience during the present meeting.

2. WHEREAS, The sale of the Barnes collection of Lepidoptera to the Government for the benefit of the United States National Museum is being actively promoted, and

WHEREAS, The interests of Entomology at large, as involved in governmental support, seem to demand competent and disinterested consideration, therefore be it

Resolved: That a committee of three be appointed by the president to consider measures proposed, and to report its findings at an early date to the Secretary of Agriculture, to the Secretary of the Smithsonian Institution, and to the Chief of the Bureau of Entomology.

3. *Resolved:* That there be established by this Society a permanent committee on general entomological terms; such committee to recommend for adoption by the Society a preferred usage respecting such terms as appear to be current in conflicting and confusing form.

After some discussion the report was adopted and the president appointed the following committee to consider the proposed sale of the Barnes collection: E. P. Felt, Chairman, Clarence H. Kennedy, and Paul S. Welch.

The President subsequently appointed the following permanent committee on general entomological terms: E. M. Walker, Chairman, G. C. Crampton, W. M. Wheeler, A. L. Melander, A. L. Quaintance.

The following papers were then presented:

53. Some Chemotropic Experiments with the Boll Weevil, and its Olfactory Organs. (By title). N. E. MCINDOO, U. S. Bureau of Entomology.
54. Binomics of *Hippodamia 13-punctata* L. (10 min.) C. R. CUTRIGHT, Ohio Agricultural Experiment Station.
55. A Remarkable Mayfly from Eastern Tennessee. (10 min.) CLARENCE H. KENNEDY, Ohio State University.
56. Some Aids in the Teaching of Entomology. (15 min.) (Lantern). C. L. METCALF and R. D. GLASGOW, University of Illinois.
57. On the Nature of the Color Patterns in Heteroptera with Data on the Effects produced by Temperature and Humidity. (15 min.) (Lantern). H. H. KNIGHT, University of Minnesota.

The attendance at this session was about 75.

It was moved and seconded that no symposium be presented at the Washington meeting. This motion was lost. It was moved that the symposium be restricted to one half-day session and the selection of the subject be left to the Executive Committee. Motion carried.

Saturday Afternoon Session,

December 29, 1923.

The Society was called to order by the president at 1:45 P. M. in Room 18, Hanna Hall Annex, and the following program was presented:

58. Some Notes on the Behavior of a Water Bug. (8 min.) (Lantern). H. B. HUNGERFORD, University of Kansas.
59. Generic Significance of the Genitalia of the Homoptera. (By title) Z. P. METCALF, North Carolina State College.
60. The Cicadellid genus *Acinopterus*, with Special Reference to the Genitalia. (10 min.) (Lantern). PAUL B. LAWSON, University of Kansas.
61. The Leaf-mining Habit in the Coleoptera. (By title). S. W. FROST, Pennsylvania State College.
62. Entomological Investigations in Siberia and Japan. (30 min.) T. D. A. COCKERELL, University of Colorado.
63. An Analysis of the Discontinuous Variation in Size of the Parasite *Dasymutilla bioculata* Cresson. (10 min.) CLARENCE E. MICKEL, University of Minnesota.
64. The Occurrence of Mites in the Tracheal System of Certain Grasshoppers. (10 min.) PAUL S. WELCH, University of Michigan, and L. P. WEHRLE, Cornell University.
65. Notes on Some Neotropical Reduviidæ. (By title). S. B. FRACKER, Madison, Wisconsin, and S. C. BRUNER, Havana, Cuba.
66. Classification of the North American Pangoninæ. (By title). JAMES S. HINE, Ohio State University.
67. A Generic Revision of North American Culicidæ. (By title). ROBERT MATHESON, Cornell University.
68. Paradichlorobenzene Sublimation, its Limitations as a Greenhouse Fumigant, with Notes on its Effect on Insects. (By title) J. W. BULGER, Ohio State University.
69. The Biology of *Macrocentrus ancylivora*, an Important Parasite of the Strawberry Leaf-roller. (By title). DAVID E. FINK, Rivertown, N. J.

The attendance at this session was about 75.

Closing Session, Saturday Evening,

December 29, 1923.

The Society convened in the Chemistry Auditorium at 8:00 P. M. for the Annual Public Address. Dr. James G. Needham, of Cornell University, under the title "The Role of Insects in Food Production" presented a much neglected phase of Entomology. Investigation has shown how this class of animals, so commonly considered a menace to mankind, possesses wholly unappreciated possibilities in the production of the most delicate and highly prized foods, especially game-birds and fishes.

EXHIBIT.

The following exhibits were open for examination during the entire meeting, in the Library Room of Hanna Hall Annex.

Some Drawings for the Monograph, "Plecoptera of North America." J. G. NEEDHAM and P. W. CLAASSEN, Cornell University.

Peripatus novæ-zealandiæ Hutton. DAYTON STONER, University of Iowa.

Life-Histories of Microlepidoptera. ANNETTE F. BRAUN, Cincinnati, Ohio.

Protective Structures of the Membracidæ. W. D. FUNKHOUSER, University of Kentucky.

Some Aids in the Teaching of Entomology. R. D. GLASGOW and C. L. METCALF, University of Illinois.